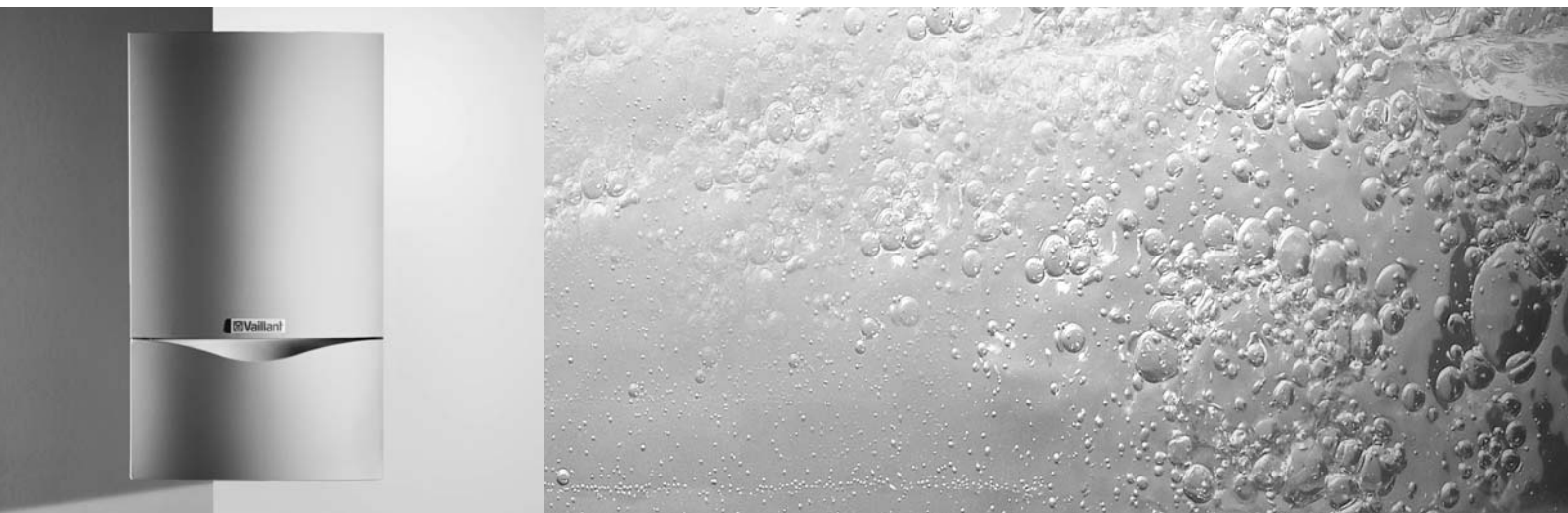


For the installer



Installation and maintenance manual ecoMAX



Wall hung room sealed fan assisted condensing boiler

ecoMAX 646

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Notes on the documentation

The following information is intended to guide you through the entire documentation. Further documents apply in combination with this installation and maintenance manual. We accept no liability for any damage caused by non-observance of these instructions.

Other relevant documentation and service aids

For the owner of the system

Brief operating instructions	No. 00 20 00 64 61
Operating manual	No. 00 20 01 46 08
Warranty cards	No. 80 29 22

For the installer

Installation Manual	
Flue accessories	No. 00 20 01 46 06
Checklist	No. 00 20 02 01 60
Sticker with name of appliance	No. 83 42 24
Installation template	No. 12 41 82
Safety sticker	No. 83 55 93

Service aids:

The following test and measuring equipment is required for inspection and maintenance:

- CO₂ measuring device
- U-pipe pressure gauge

Attachment and storage of the documents

Please pass on this installation and maintenance manual as well as the aids to the owner of the system, whose responsibility it is to ensure that the manuals and auxiliary equipment are available whenever required.

Symbols used

Please observe the safety instructions in this installation manual when installing the appliance!



Danger!

Immediate risk of serious injury or death!



Caution!

Potentially dangerous situations for product and environment!



Note!

Useful information and instructions.

- **Symbol for a necessary task**

1 Description of the appliance

1 Description of the appliance

1.1 Design

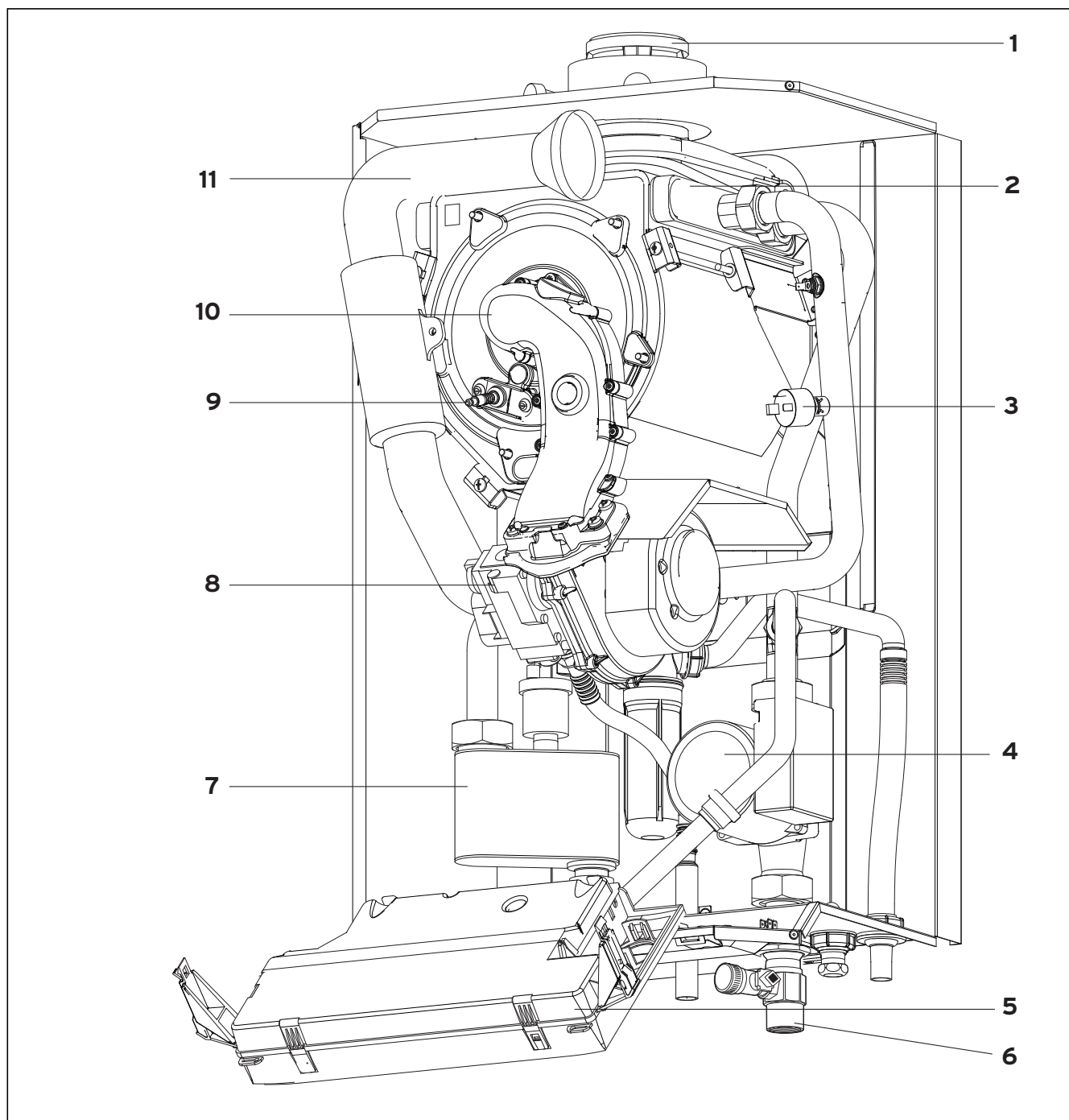


Fig. 1.1 Function elements

- 1 Connection for the flue pipe
- 2 Heat exchanger
- 3 Pressure switch
- 4 Pump
- 5 Electronics box
- 6 KFE cock

- 7 Air separator
- 8 Gas fitting
- 9 Ignition electrode
- 10 Compact thermal module
- 11 Air intake pipe

1.2 Type summary

Appliance type	Country of destination (designations according to ISO 3166)	License category	Type of gas	Nominal heat output range P (kW)	Storage charging output (kW)
ecoMAX 646	GB (Great Britain)	II _{2H3P}	Natural gas H - G 20 -20 mbar (Propane - G 31 - 37 mbar)	13.3 - 47.7 (40/30 °C) 12.3 - 44.1 (80/60 °C)	44.1

Table 1.1 Type summary

1.3 Data badge

The data badge of the Vaillant ecoMAX 646 is attached at the factory to the bottom of the appliance.

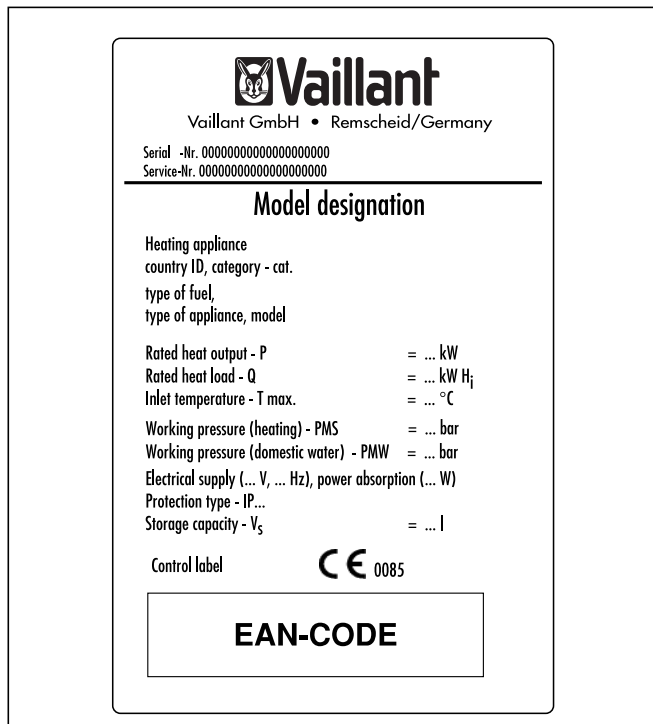


Fig. 1.2 Data badge (example)

1.4 CE marking

CE marking is used to document the fact that the appliances, in accordance with the type summary, meet the basic requirements of the directive on appliances burning gaseous fuels (Council Directive 90/396/EEC) and the EC directive on electromagnetic compatibility (Council Directive 89/336/EEC). The appliances meet the basic requirements of the efficiency requirements directive (Council Directive 92/42/EEC).

The appliances meet the basic requirements of the efficiency requirements directive (Council Directive 92/42/EEC) as condensing appliances.

1.5 Intended use

The Vaillant ecoMAX 646 is a state-of-the-art appliance which has been constructed in accordance with recognised technical safety regulations. Nevertheless, danger to the life and limb of the user or third parties can still occur or the appliance or other material assets be damaged when using it.

The appliance is designed to be used as a heater for closed hot water central heating systems. Any other use or extended use is considered to be improper. The manufacturer or supplier is not liable for any damage resulting from improper use. The user alone bears the risk. Appropriate use includes the observance of the operating and installation manual and the adherence to the inspection and maintenance conditions.

2 Safety instructions

2 Safety instructions and regulations

2.1 Safety instructions

2.1.1 Installing and setting the appliance



Important!

The appliance must be installed and serviced by a competent person as stated in the Gas Safety (Installation and Use) Regulations 1998. In IE, the installation must be in accordance with the current edition of IS 813 'Domestic Gas Installations', the current Building Regulations and reference should be made to the current ETCI rules for electrical installation.

2.1.2 Smell of gas

If you smell gas, the following safety instructions should be observed:

- don't switch on any electrical switch in the danger area,
- don't smoke in the danger area,
- don't use a telephone in the danger area,
- close the gas stop cock,
- air the danger area,
- notify a gas supplier or recognised gas fitting company.

2.1.3 Changes to the surroundings of the boiler

No changes must be made to the following devices:

- the boiler
- the gas, air, water and electricity supply pipes
- the exhaust pipe
- the discharge pipe and the safety valve for the hot water
- the constructional conditions that could affect the operational reliability of the device.

2.1.4 Important instructions for propane appliances

Bleeding the liquid gas tank when installing the system: before installing the device, make sure that the gas tank has been bled. The liquid gas supplier is responsible for the proper bleeding of the tank. Ignition problems can be caused if the tank is not bled properly. In such cases, first contact the person in charge of filling the tank.

Affixing the tank sticker:

Affix the enclosed tank sticker (propane quality) on the tank where it is clearly visible or on the bottle cabinet, if possible close to the filler nozzle.

Installing underground:

When installing in underground places, the requirements of the TRF 1996 (technical rules for liquid gas) are to be observed. We recommend the use of an external solenoid valve.

Connection set for external solenoid valve:

Item no.: 306 253 or 306 248



Danger!

Only propane in accordance with DIN 51622 may be used.



Important!

When tightening or slackening screwed connections always use suitable open-ended spanners (not pipe wrenches or extensions etc.). Incorrect use and/or unsuitable tools can lead to damage being caused (e.g. gas or water leakage)!

2.2 General requirements

2.2.1 Preliminary remarks for roomsealed appliances

This appliance should only be installed in conjunction with either a Vaillant flue system or an alternative approved system (details of flue approval categories can be found in the technical section of the installation manual). Install the flue system as detailed in the separate flue installation instructions supplied with this boiler.

2.2.2 Related documents

The installation of the boiler must be in accordance with the relevant requirements of Gas Safety (Installation and Use) Regulations 1998, Health and Safety Document No. 635 (The Electricity at Work Regulations 1989), BS7671 (IEE Wiring Regulations) and the Water Supply (Water Fitting) Regulations 1999, or The Water Bylaws 2000 (Scotland). It should also be in accordance with the relevant requirements of the Local Authority, Building Regulations, The Building Regulations (Scotland). The Building Regulations (Northern Ireland) and the relevant recommendations of the following British Standards:

- BS 6700: Services supplying water for domestic use within buildings and their curtilages.
- BS 6798: Specification for installation of gas fired boilers not exceeding 60 kW input.
- BS 6891: Specification for installation of low pressure gas pipework up to 28 mm (R1) in domestic premises (2nd family gas).
- BS 7593: Treatment of water in domestic hot water central heating systems. Institute of Gas Engineers Publication IGE/UP/7/1998: "Guide for gas installations in timber framed housing"
- BS. 5482 Pt. 1 Domestic butane and propane gas burning installations.
- IGE/UP1 Soundness testing and purging of industrial and commercial gas installation.
- IGE/UP2 Gas installation pipework, boosters and compressors on industrial and commercial premises.
- IGE/UP10 Installation of gas appliances in industrial and commercial premises.
- BS. 6644 Installation of gas fired hot water boilers of rated inputs between 60 kW and 2 MW (2nd and 3rd family gases).

- BS. 5449 Forced circulation hot water central heating systems for domestic premises.
Note: only up to 45 kW.
- BS. 6880 Low temperature hot water heating systems of output greater than 45 kW.
Part 1 Fundamental and design considerations.
Part 2 Selection of equipment.
Part 3 Installation, commissioning and maintenance.
- BS. 4814 Specification for: Expansion vessels using an internal diaphragm, for sealed hot water heating systems.
- BS. 5440 Installation and maintenance of flues and ventilation for gas appliances of rated input not exceeding 70 kW net (1st, 2nd and 3rd family gases).
Part 1 Specification for installation of flues.
Part 2 Specification for installation and maintenance of ventilation for gas appliances.



Important!

When tightening or loosening screwed connections always use suitable open-ended spanners (not pipe wrenches or extensions etc.). Incorrect use and/or unsuitable tools can lead to damage being caused (e.g. gas or water leakage)! Preliminary remarks: This appliance should only be installed in conjunction with a Vaillant flue system. Install the flue system as detailed in the separate flue installation instructions supplied with this boiler.

Boiler location

The location chosen for the boiler must permit the provision of a satisfactory flue termination. The location must also provide adequate space for servicing and air circulation around the boiler. The boiler may be installed in any room, although particular attention is drawn to the requirements of BS7671 (IEE Regulations), the electrical provisions of the Building Regulations (Scotland) and in IE the current edition of IS 813 and the current ETCI rules, in respect of the installation of a boiler in a room containing a bath or shower.



Note!

Where a room sealed boiler is installed in a room containing a bath or shower, any electrical switch or boiler control utilising mains electricity should be so situated that it cannot be touched by a person using the bath or shower.

Where the installation of the boiler will be in an unusual location, special procedures may be necessary and BS 5546 and BS 6798 give detailed guidance on this aspect. The boiler must be mounted on a flat, vertical wall, which must be sufficiently robust to take the weight of the boiler. The boiler may be installed on a combustible wall, subject to the requirements of the Local Authorities and Building Regulations.

A compartment used to enclose the boiler must be designed and constructed specifically for this purpose. (An existing cupboard or compartment may be used provided that it is modified for the purpose). Details of essential features of cupboard/compartment design including airing cupboard installations are given in BS 6891. In IE the current edition of IS 813. If the boiler is to be fitted in a timber framed building, it should be fitted in accordance with Institute of Gas Engineers Publication IGE/UP/7/1998 "Guide for Gas Installation in Timber Framed Housing".

Gas Supply

The gas supplier should ensure the availability of an adequate supply of gas. A gas meter may only be connected to the service pipe by the supplier of gas or their contractor. An existing meter should be checked to ensure that it is capable of passing the rate of gas supply required. Installation pipes should be fitted in accordance with BS 6891. Pipework from the meter to the boiler must be of an adequate size. Do not use pipes of a smaller size than the boiler gas connection (15 mm, 22 mm for 837/637). The complete installation must be tested for soundness and purged as described in BS 6891.

3 Mounting

3 Mounting

The Vaillant ecoMAX 646 is delivered pre-mounted in a package unit.

3.1 Scope of delivery and accessories

Scope of delivery

Check that all the parts have been delivered intact (see fig. 3.1 and table 3.1).

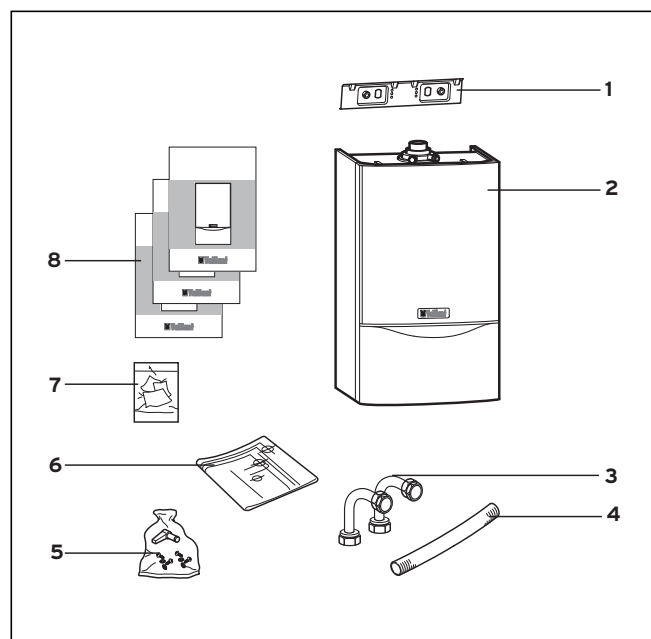


Fig. 3.1 Scope of delivery

Position	Quantity	Name
1	1	Bracket
2	1	Appliance
3	2	Connector - storage charging circuit
4	1	Condensate discharge hose
5	1	Bag containing consumables
6	1	Installation template
7	3	Manuals: Operating manual Installation manual Assembly manual for flue pipe

Table 3.1 Scope of delivery

3.2 Installation site

Please note the following safety instructions below before choosing where to install the appliance:



Caution!

Do not install the appliance in rooms prone to frost. In rooms with aggressive steam or dust, the appliance must be operated independently of the ventilation!

When choosing the place of installation and while operating the appliance, make sure that the combustion air is technically free of chemical substances containing fluorine, chlorine, sulphur etc. Sprays, solvents and cleaning agents, paints, adhesives etc. contain these kinds of substances, which - in the worst case scenario - can lead to corrosion, even in the exhaust system, during ambient air dependent operating of the appliance. The appliance must be operated independently of the ambient air particularly in hairdressing salons, carpenter's shops or paint shops, cleaning companies. Otherwise, a separate installation room is required to guarantee that the combustion air supply is technically free of the above mentioned substances.

3.3 Dimensional drawing and connections

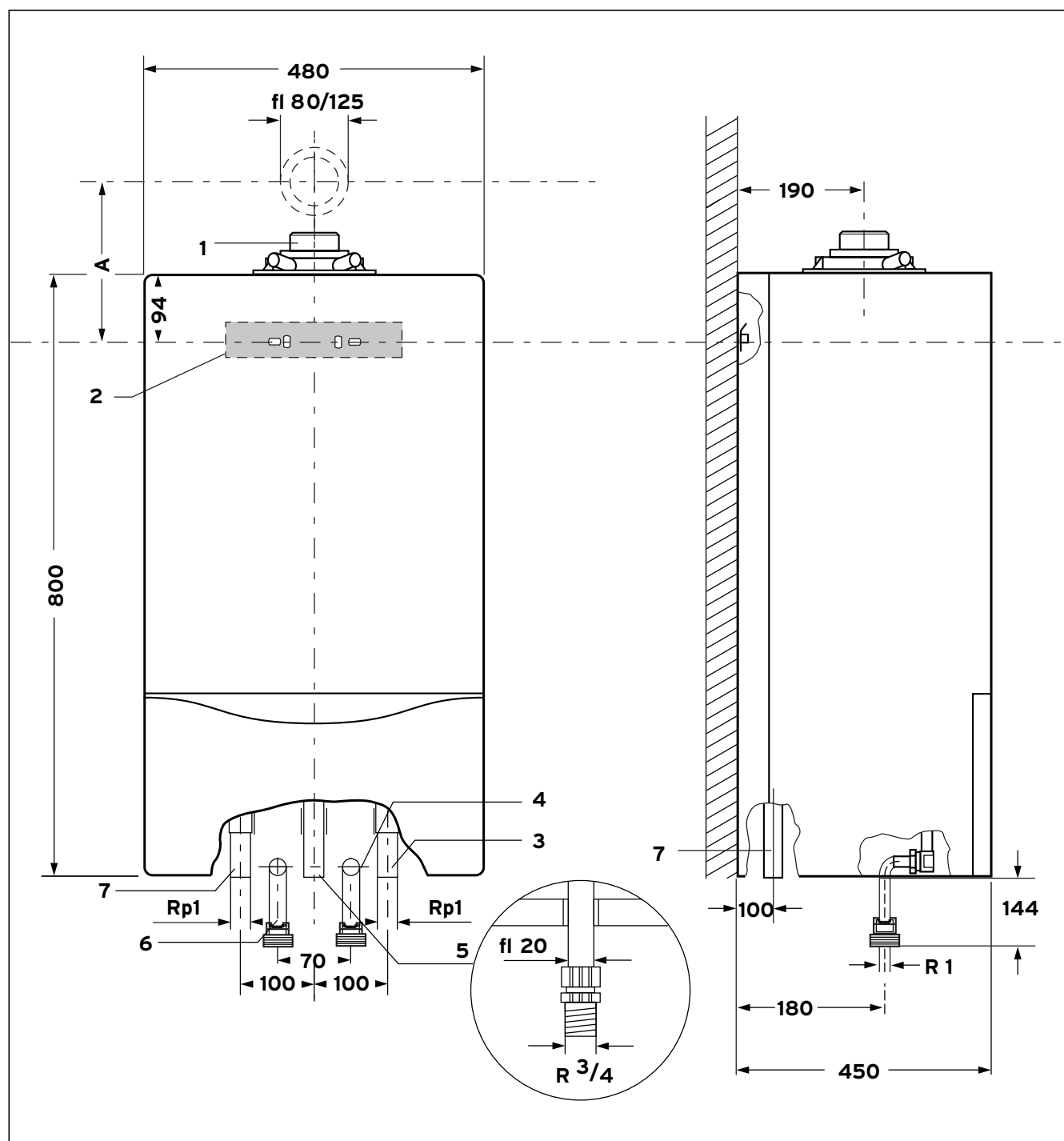


Fig. 3.2 Connection dimensions

- 1 Flue connection \varnothing 80/125 mm
Dimension A with 87° elbow: 253 mm
Dimension A with 87° T-piece: 270 mm
- 2 Appliance holder
- 3 Heating return
- 4 Charging circuit return (only in conjunction with cylinder)
- 5 Gas connection
- 6 Charging circuit supply (only in conjunction with cylinder)
- 7 Heating supply

3 Mounting

3.4 Required minimum gaps/assembly clearances

Both for the installation/assembly of the appliance and for carrying out maintenance tasks later, you need the minimum gaps and assembly clearances given below:

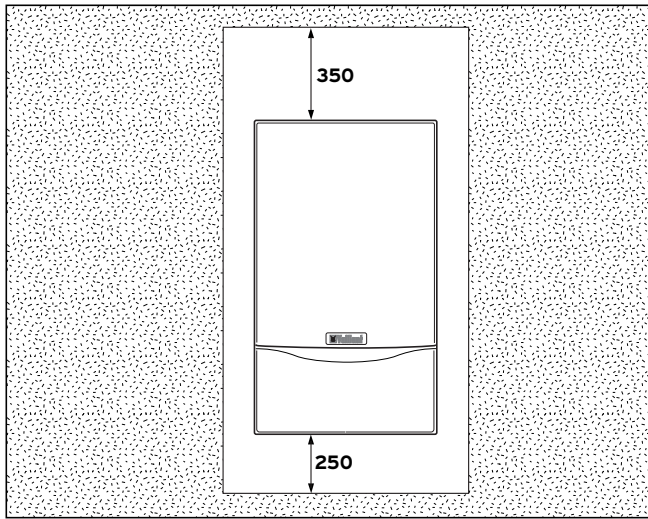


Fig. 3.3 Required minimum gaps/assembly clearances

Leaving gaps to the sides is not necessary. Furthermore, it is not necessary to keep a gap between the appliance and components made of combustible constituents, since at the rated heating power of the appliance, the temperature here is never higher than the permitted temperature of 85 °C.

3.5 Mounting the appliance

- Hang the appliance up into the appliance holder (1) from above with the bracket (3).
- Mount the cable connections to the appliance, making sure they are disconnected from the power supply.

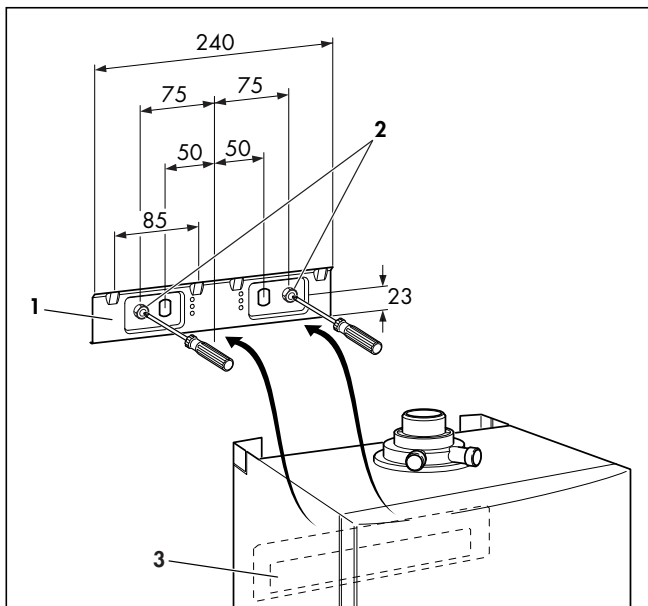


Fig. 3.4 Mounting the appliance

3.6 Removing/Attaching the appliance casing

Removing the casing

To dismantle the front casing of the appliance, proceed as follows:

- Unscrew the screw (1) on the bottom of the appliance.
- Press in both holding clips (2) on the bottom of the appliance so that the casing comes loose.
- Pull the casing (3) forwards by its bottom edge and lift the casing up and off (4).

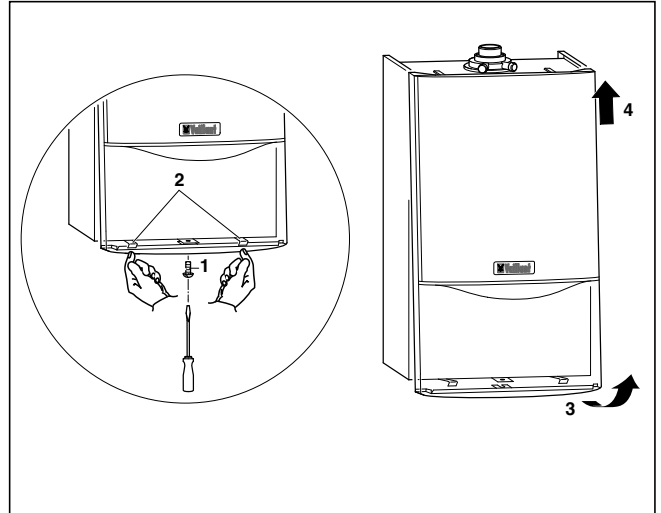


Fig. 3.5 Removing/Attaching the appliance casing

Attaching the casing

To mount the casing, proceed as follows:

- Place the casing on the upper appliance holders.
- Push the casing onto the appliance so that the holding clips (2) on the casing click into place.
- Fix the casing by screwing in the screw (1) on the bottom of the appliance.

4 Installation

When installing, please observe the following points in particular:

- Install the filling device in the return
- Guarantee minimum circulation by means of an overflow valve or hydraulic switch

When recharging:

- Install the storage charging pump
- Install gravity brake in the heating supply and in the storage charging circuit

4.1 Preparing the installation

Safety equipment for an emergency

- From the safety valve's blow-out line, a drain pipe with intake guide and siphon must be led to a suitable outlet. The outlet must be visible!
- If plastic pipes are used in the heating system, a suitable maximum thermostat must be mounted on the heating supply (e.g. Vaillant feed thermostat 009 642). This is necessary in order to protect the heating system from temperature-related damage in the event of a malfunction.
- When using plastic pipes that are not diffusion tight in the heating system, a system separation between the heater and system by means of an external heat exchanger must be performed in order to avoid corrosion occurring in the heater circuit or in the boiler.

4.2 Technical instructions for the heating system



Caution!

The following system diagrams are schematic diagrams. They do not replace the full professional diagrams!

The system diagrams do not contain the shut-off devices and safety devices necessary for correct mounting.

Observe the applicable standards and guidelines.

4.2.1 Direct feeding with heating pump located in the interior of the device

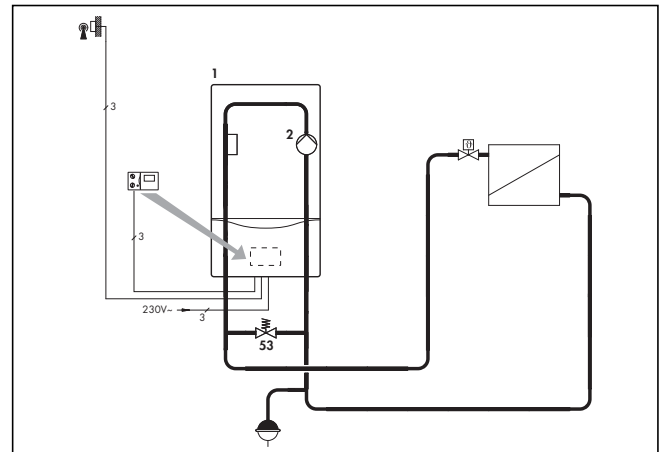


Fig. 4.1 Example 1: radiator heating, direct feeding, appliance-internal pump

- 1 ecoMAX 646
- 2 heating pump
- 53 overflow valve (on site)

Pump layout; system dimensioning

The system planning is to be done such that in the design point optimally a water volume of:

$$V = 2000 \text{ l/h with } \Delta T = 20 \text{ K}$$

flows through the device and system.

The resulting residual delivery head for the system dimensioning is to be taken from fig. 4.2.

Setting the overflow valve

In order to guarantee the minimum circulating water volume of 1150 l/h through the appliance, install and set the overflow valve.

We recommend you set the overflow valve to 250 mbar with regard to possible noises at thermostat valves. The overflow valve can, however, be set at up to 400 mbar.

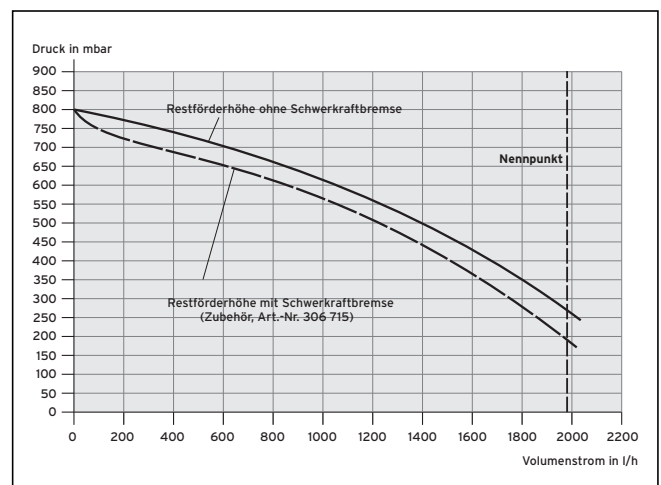


Fig. 4.2 Resulting characteristic curve (residual delivery head) ecoMAX 646

4 Installation

4.2.2 Hydraulic decoupling with heating pump located on the appliance side

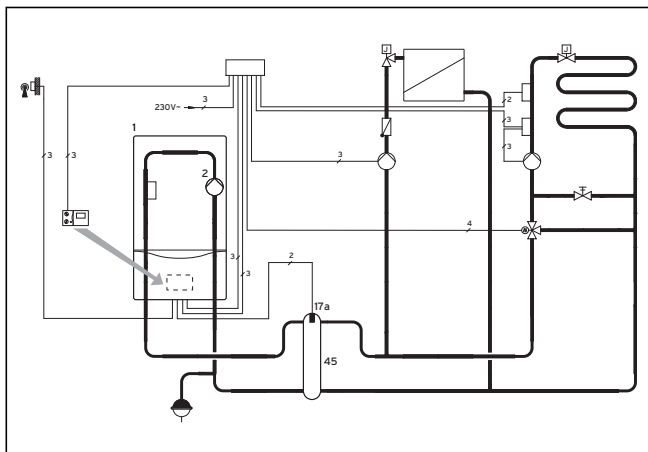


Fig. 4.3 Example 2: radiator heating and floor heating, hydraulic separation, appliance-internal pump

- 1 ecoMAX 646
- 2 heating pump (appliance-internal)
- 13 weather-based controller VRC 420s
- 13a mixer module
- 17a supply temperature sensor

Pump layout in the heater circuit

The appliance pump is set according to table 4.1.

	with gravity brake	without gravity brake
Pump output	100 %	80 %

Table 4.1: pump output

The pump output must be set to the values in the table (in the DIA system under point d.14).

Selection of the hydraulic switch

A suitable WH model hydraulic switch (accessory) can be selected with the aid of table 4.2.

A sufficiently large water volume (minimum circulating water volume) is constantly supplied through the boiler via the hydraulic switch in conjunction with the pump built into the boiler.

heating system output	heating system spread		
	10 K	15 K	20 K
ecoMAX 646	WH 95	WH 40	WH 40
double cascade	WH 160	WH 95	WH 95
triple cascade	WH 280	WH 160	WH 160
quadruple cascade	WH 280	WH 160	WH 160

Table 4.2: Selection of the hydraulic switch, WH model

4.3 Technical instructions for recharging

Recharging kit (accessory)

Mounting instructions are to be taken from the manual supplied with the recharging kit.

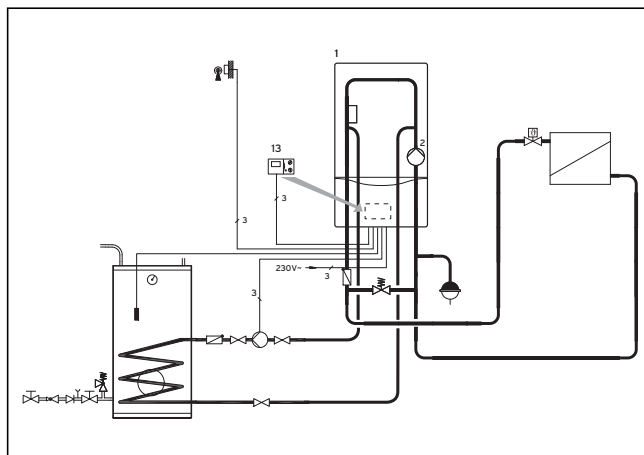


Fig. 4.4 Example 3: use of a cylinder, direct heating circuit

- 1 ecoMAX 646
- 2 heating pump (appliance-internal; accessory)
- 13 weather-based controller VRC 410

Recharging without accessories

It is imperative to keep to the minimum volume flow of the charging circuit of 1800 l/h.

When dimensioning, pay attention to the pressure losses of the gravity brake, the piping and the cylinder.

The heating circuit's gravity brake is to be put in the heating supply; the storage charging circuit's gravity brake can be mounted anywhere you like.

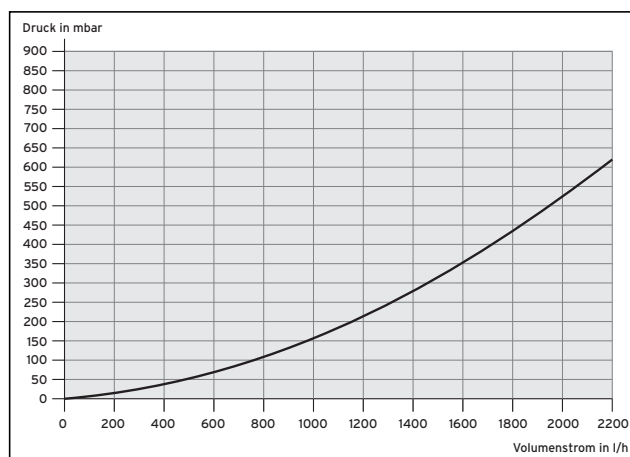


Fig. 4.5 The appliance's storage charging circuit without brake and cylinder (the appliance's pressure loss characteristic curve)

4.4 Gas connection



Caution!

Ensure the gas line is disconnected from the power supply when mounting it so that no leaks are caused.



Caution!

The checking of the gas ducts for leaks may only be carried out with a maximum pressure of 50 mbar, since otherwise the gas valve might get damaged.

The appliance must be connected to your gas line via a gas ball cock with a fire protection apparatus.

- Screw the appliance's gas supply pipe (1) gas-tight with the (pre-installed) gas ball cock (2). To do this, use the R3/4 compression fitting supplied with the appliance. This is suitable for the connection of a R3/4 gas ball cock.
- Inspect the gas connection for leakage.

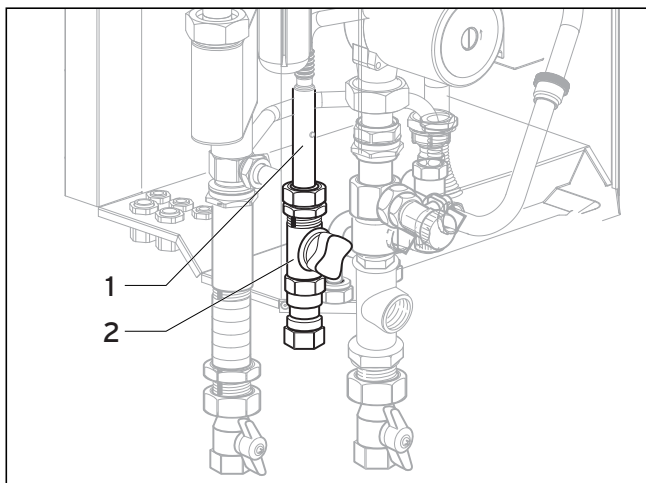


Fig. 4.6 Gas connection (only surface installation possible)

4.5 Heating side connection



Caution!

Ensure the connecting cables are disconnected from the power supply when mounting them so that no leaks are caused in the heating system.

The appliance is connected to the heating supply and return via maintenance cocks. An installation set for the ecoMAX 646 is available (item no. 306 715).



Caution!

It is imperative that the filling device be mounted in the return; otherwise, the bleeding of the appliance is not guaranteed.



Note!

When using a cylinder, a gravity brake is to be mounted in the supply.

- Screw in supply (3) and return (4) with the maintenance cocks.

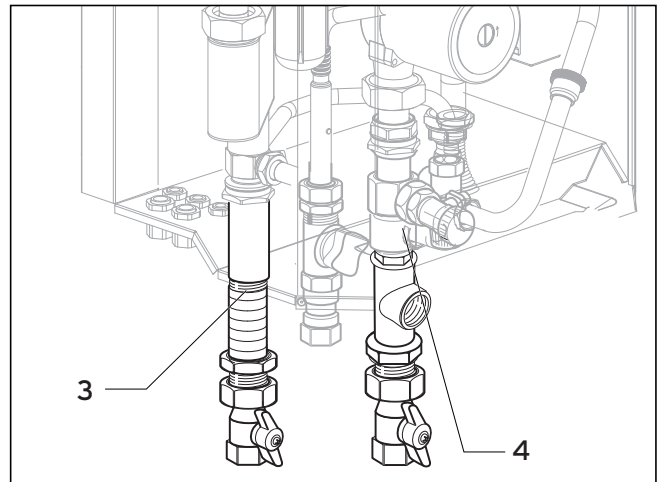


Fig. 4.7 Mounting the heating supply and return

4.6 Flue pipe



Danger!

Only use original Vaillant flue pipes, since these are authorized together with the boiler. Malfunctions can occur if you use other accessories. These may result in damage and injury.

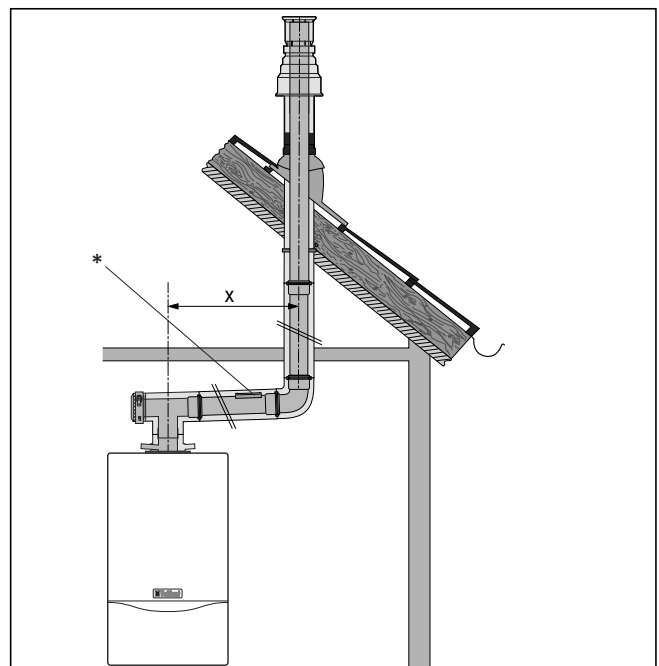


Fig. 4.8 Mounting example - vertical roof duct

* In case of $x > 1$ m an inspection hole has to be provided

4 Installation

Concentric systems made of plastic (diameter - 80/125 mm) are combined with the appliance as flue pipes. The most suitable system depends on the specific installation and application conditions (see also the installation manual 83 44 49 for the flue pipes).

- Mount the flue pipes consulting the installation manual contained in the scope of delivery of this appliance.

4.7 Condensate discharge

The condensate generated during combustion is led from the condensate discharge pipe to the waste water connection via a draining funnel.



Caution!

The condensate discharge pipe may not be connected tight to the waste water line.

- Connect the supplied condensate discharge hose (1) to the pre-installed draining funnel (2).

The draining funnel also serves to drain off any heating water that may be escaping at the safety valve. If the condensate discharge line needs to be extended during installation, only use DIN 1986/EN 12056 compliant drain pipes.

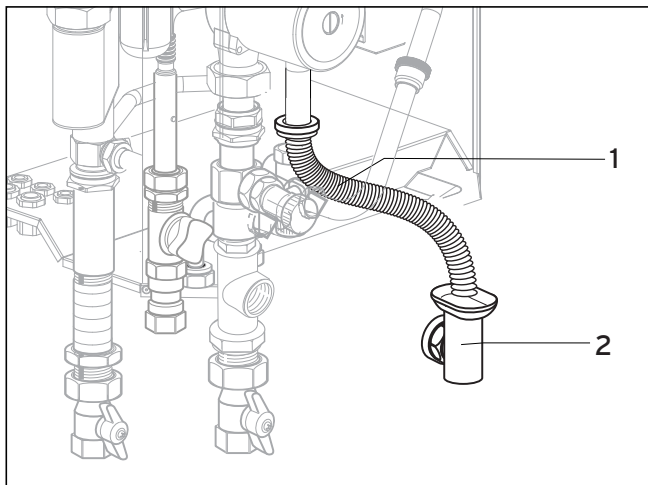


Fig. 4.9 Condensate discharge

4.8 Electrical connection



Danger!

Risk of fatal electric shock from touching live connections. Always switch off the power supply to the boiler first. Only once this is done may you carry out the installation. There is continuous operating voltage at the power supply terminals L and N even when the main switch is switched off.

4.8.1 Mains connection



Caution!

Supplying power to false plug terminals of the Pro E system can destroy the electronics. Only connect the mains supply to the terminals that are marked as being for that purpose.

The rated voltage of the mains must be 230 V; at rated voltages above 253 V and under 190 V, functional impairments are possible.

The mains supply must be connected via a fixed connection and a separator with a contact opening of at least 3 mm (e.g. fuses, circuit breakers).

4.8.2 Connecting controllers

Mounting is to be carried out as instructed in the relevant installation manual. The necessary connections to the boiler's electronics (e.g. when using external controllers, external sensors or similar devices) are to be performed as follows:

- Take off the front casing of the appliance and lift the electronics box (1) forward.
- Unclip the back cover (2) of the electronic box from its fixings (3) and lift it up.
- Guide the connecting cables of each of the components to be connected through the cable routes (4) located on the bottom of the appliance to the left.

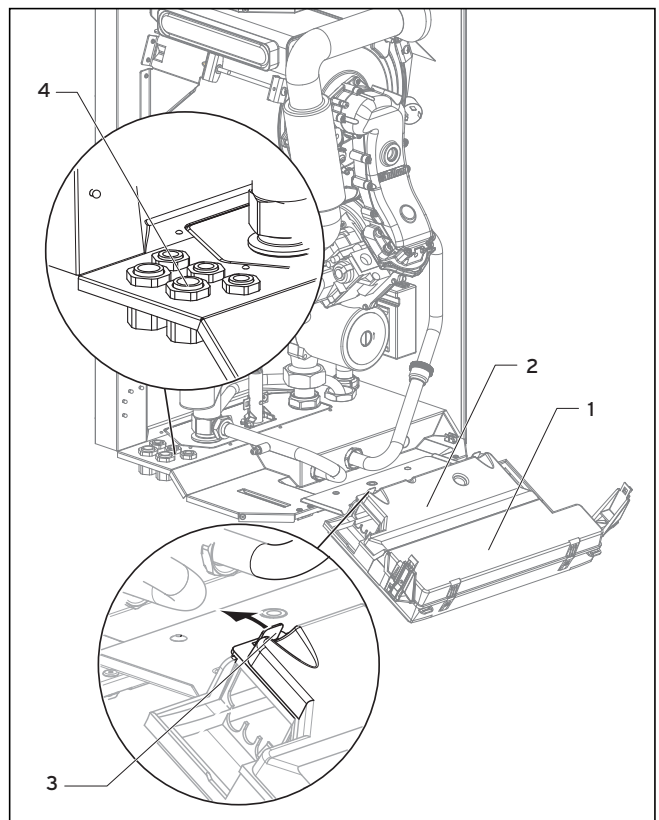


Fig. 4.10 Opening the rear of the switch box

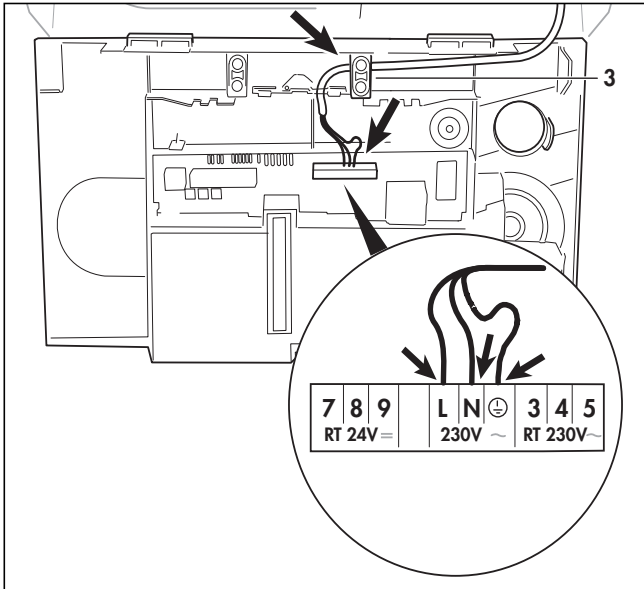


Fig. 4.11 Example of cable insertion

- Then insert the connecting cables (5) into the electronics box and cut them to length.
- Strip the connecting cable by about 2-3 cm and bare the wires.
- Connect the connecting cables to the corresponding ProE plugs or slots of the electronics.



Caution!

Do not connect the mains voltage supply to terminals 7, 8, or 9. The electronics could be destroyed by this!

- If no room/clock thermostat is in place, provide a jumper between terminals 3 and 4 if not already present. Remove the jumper if a room/clock thermostat is connected to terminals 3 and 4.
- When connecting a weather-controlled temperature controller or room temperature controller (continuous controlling - terminals 7,8,9), the jumper between terminals 3 and 4 must remain in place.
- Close the rear cover of the electronics box and press it in until you hear it click into place.
- Lift up the electronics box and press it by the two clips on its left and right against the lateral appliance casings until you hear the clips click into place.
- Attach the front casing.
- In order to attain pump mode I (continuous pump) for VRC-MF-TEC or the multicircuit controller, increase the pump run-out time to 15-20 minutes (diagnosis point d.1, see chapter 6.2).

4.8.3 Connecting accessories and external system components

The Vaillant ProE system facilitates a quick and trouble-free connection of accessories and external system components to the appliance electronics. Proceed with the wiring up as follows:

- Take off the front casing of the appliance and lift the electronics box forward.
- Unclip the back cover of the switch box (1) from its fixings (2) and lift it up.
- Guide the connecting cables of each of the components to be connected through the PG screw connections (4) located on the bottom of the appliance to the left.
- Then insert the connecting cables (5) into the electronics box and cut them to length.
- Strip the connecting cable by about 2-3 cm and bare the wires.
- Connect the connecting cables to the corresponding ProE plugs or slots of the electronics.

Please note that the jumper on the ProE plug should be removed when connecting a maximum thermostat (feed thermostat) for floor heating.

- Close the rear cover of the electronics box and press it in until you hear it click into place.
- Lift the electronics box up and press it by the two clips on its left and right against the lateral appliance casings until you hear the clips click into place.
- Attach the front casing.

4 Installation

4.8.4 Connection diagram

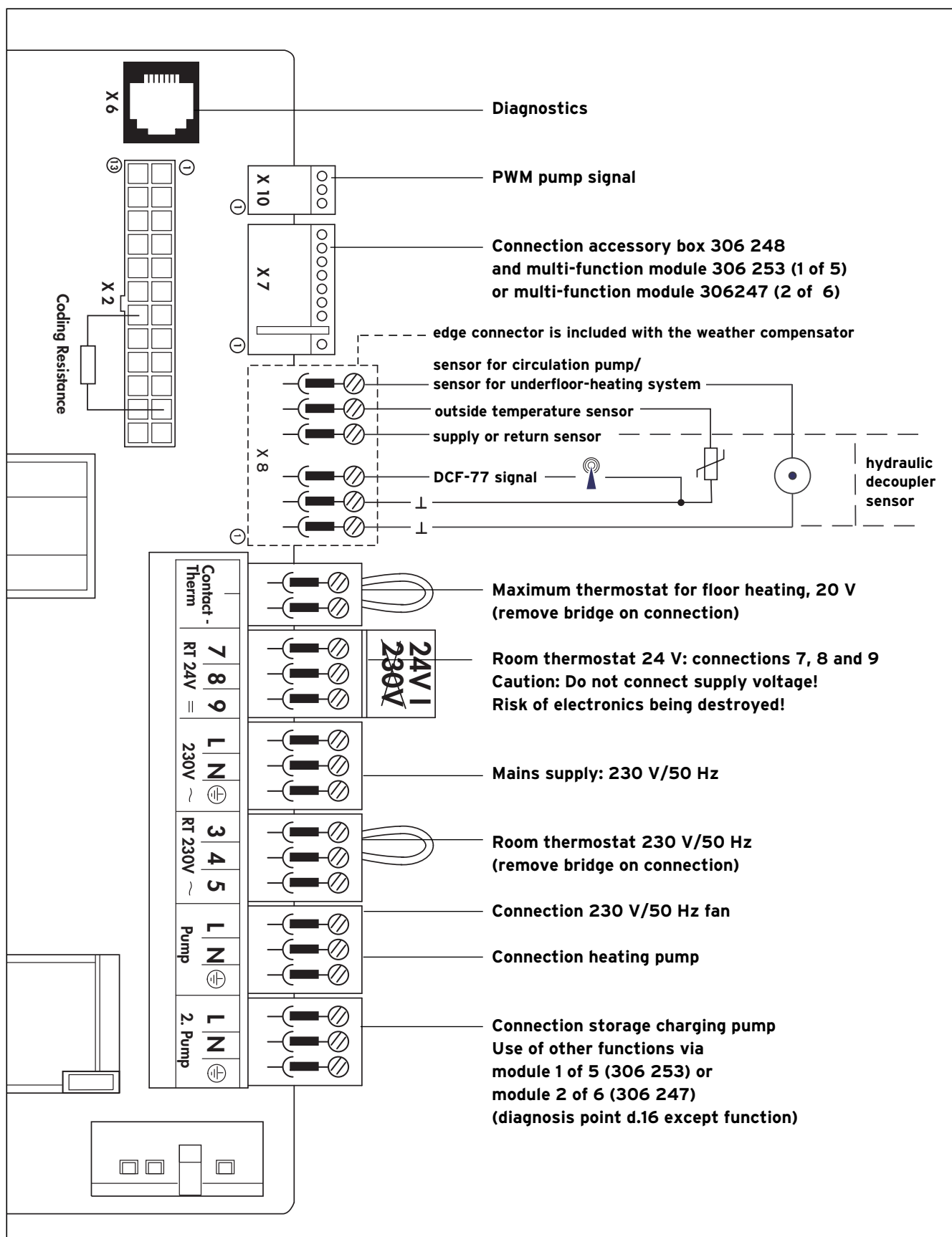


Fig. 4.12 Connection diagram ecoMAX 646

4.8.5 Wiring diagram

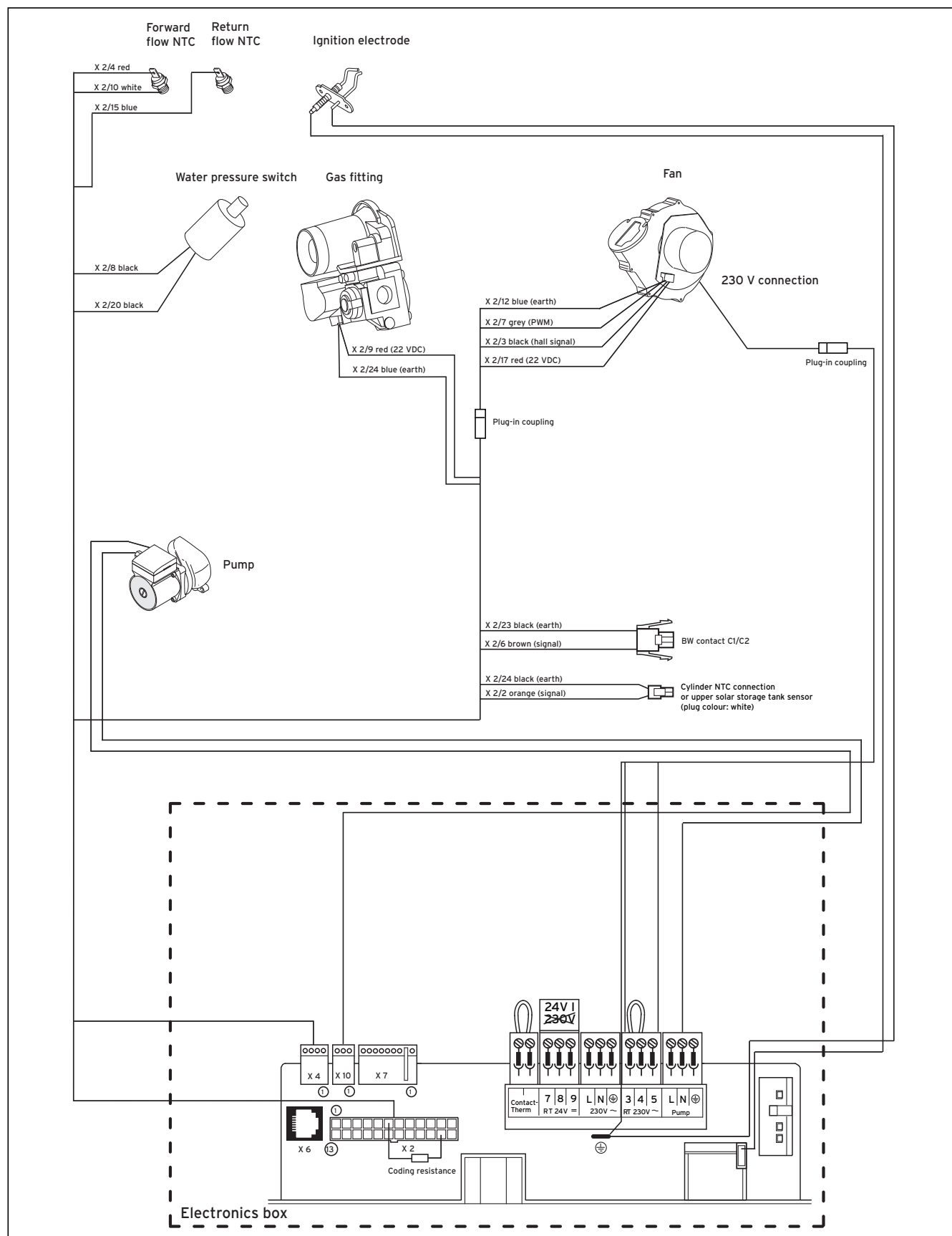


Fig. 4.13 Wiring diagram ecoMAX 646

5 Start-up

Particularly observe the following when putting the boiler into service:

- Open the cover of the exhaust fan before filling the heating circuit/storage charging circuit.
- Start the bleeding program for the heating circuit/storage charging circuit.

5.1 Water circulation system

Detailed recommendations for the water circulation system are given in BS 6798 and BS 5449: Part 1 (for small bore and micro bore central heating systems). Pipework not forming part of the useful heating surface should be insulated to help prevent heat loss and possible freezing, particularly where pipes are run through roof spaces and ventilated underfloor spaces. Draining taps must be located in accessible positions which permit the draining of the whole system including the boiler and the hot water system. Draining taps should be at least 1/2 in. BSP nominal size and be in accordance with BS 2879. The boiler is suitable for use with minibore or microbore systems. Copper tubing to BS 2871: Part 1 should be used for water carrying pipework. All capillary joints in all DHW pipework must be made with lead free solder. Particularly where a new boiler is to be fitted to an existing system, it is good practice that the system is thoroughly cleansed.



Important!

To prevent the formation of deposits and prevent serious damage to the appliance and system, cleansers must be used carefully and must be completely removed by thoroughly flushing the system. Cleansers should only be left in systems for a maximum of 24 hours.

This cleansing must take place prior to the fitting of the new boiler and be in accordance with BS 7593. For advice on the application of system cleansers contact: Sentinel, Betz Dearborn Ltd. Widnes, Cheshire, WA8 8UD. Tel: 0151 495 1861 – or Fernox, Alpha Fry Technologies, Tandem House, Marlow Way, Croydon, CR0 4XS. Tel: 0870 6015000

5.1.1 Treating the heating water



Caution!

Do not enrich the heating water with frost or corrosion protection fluid.

If you enrich the heating water with frost or corrosion protection fluid, changes can be caused in the seals and noises may arise during the heating operation. Vaillant assumes no liability for this (or for any subsequent resulting damage).

Please inform the user as to how to go about frost protection.



Caution!

Softening the heating water when water hardness is 20° dH or more is absolutely necessary.

To do this, you can use the water softening cartridge, item no. 30 13 63. Please observe the instructions supplied with it.

5.1.2 Heating side filling and bleeding

For the heating system to function perfectly, a water pressure/filling pressure of between 1.0 and 2.0 bar is necessary. If the heating system stretches out over several storeys, higher values for the water level of the system at the pressure gauge can be necessary (maximum pressure for safety valve: 3 bar).



Caution!

Only fill the system via the appliance-internal KFE cock. Otherwise bleeding problems may arise.

- Rinse the heating system thoroughly before filling it proper.
- Open the cap of the appliance-internal exhaust fan (1) (fig. 5.1).
- Open all thermostat valves in the system.
- Connect the system's filling and draining cock to the appliance return via a hose.
- Slowly unscrew the filling cock and tap valve and fill with water until the required system pressure at the pressure gauge (2) has been reached (at least 1 bar).
- Close the tap valve.
- Bleed all radiators.
- Then check the filling pressure of the system again (and repeat filling procedure if necessary).
- Start the "P.O" bleeding program (see chapter 8.1.5).



Note!

The bleeding program runs for approx. 6.5 minutes.



Caution!

For the bleeding of the system, the minimum pressure must be 0.8 bar.

If pressure is too low, the gas valve jams when the burner starts up.

- Open the filling cock and tap valve again if necessary.



Caution!

If there is still too much air in the system after the bleeding program has finished, the program must be started anew.

Caution!
After the filling process has finished

The system pressure should be at least 0.2 bar above the back pressure from the expansion tank (ET) $P_{\text{system}} \geq P_{\text{ET}} + 0.2 \text{ bar}$

- Close the filling unit and remove the filling hose.
- Inspect all connections for leakage.

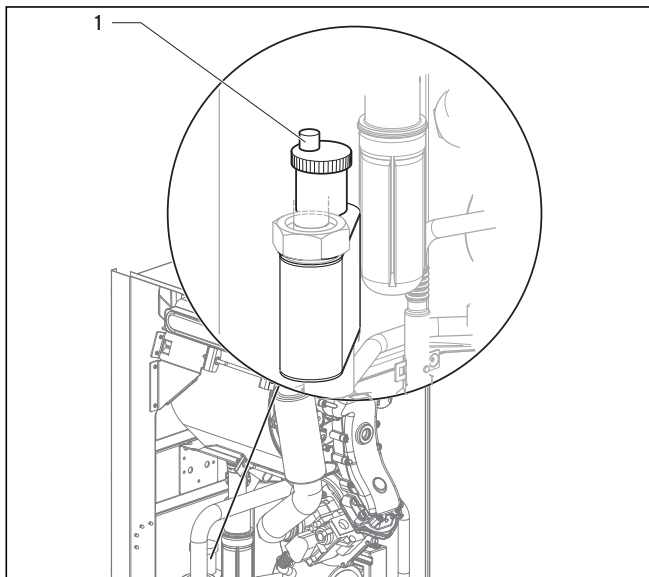


Fig. 5.1 Bleeding the appliance

5.1.3 Hot water side filling and bleeding

To fill the storage charging circuit, proceed as described in point 5.1.2.

- Restart the bleeding program (P.0).

5.1.4 Filling the siphon

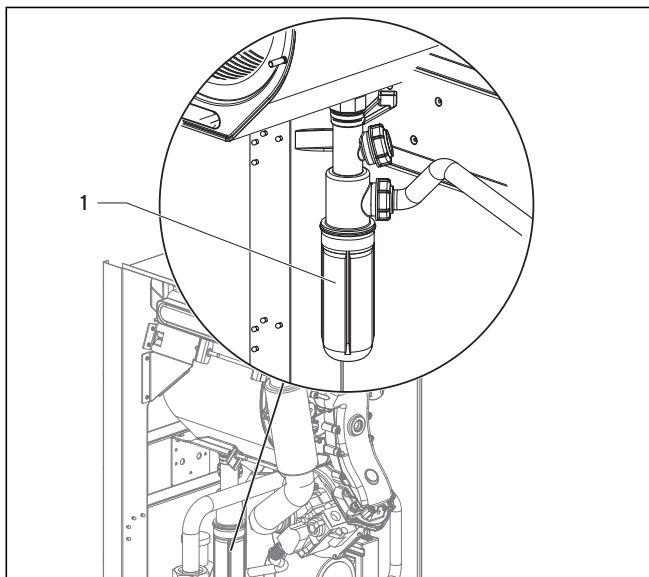


Fig. 5.2 Filling the siphon

Danger!
If the device is operated with an empty condensate siphon, there is the danger of poisoning through escaping flue gases. Therefore, it is mandatory to fill the siphon as described below before start-up.

- Screw off the bottom (1) of the condensate siphon (fig. 5.2).
- Fill the bottom about 3/4 full with water.
- Screw the bottom back on the condensate siphon.

5.2 Checking the gas setting

5.2.1 Factory gas setting

Caution!
Before starting up the appliance, compare the data on the set gas type on the data badge with the gas on site. Checking the amount of gas is not necessary. The setting takes place with regard to the percentage of CO₂ in the flue gas.

The appliances are set ex works to the values listed in table 5.1. An on site adjustment can be necessary in some supply areas.

The appliance design corresponds to the gas family available on site:

- Check the CO₂ percentage as described in chapter 5.2.3.

The appliance design doesn't correspond to the gas family available on site:

- Carry out a gas conversion.

Note!
Please ask Vaillant customer service about the gas conversion of the appliance.

- Check the CO₂ percentage as described in chapter 5.2.3.

Appliance type	ecoMAX 646
Appliance design	Natural gas H
Designation on the appliance badge	II _{2H3P}
Factory setting to Wobbe index Ws (in kWh/m ³), corresponding to 0 °C / 1013 mbar	15.0
Factory setting of the hot water output (in kW)	45
Factory setting of the heating output (in kW)	35

Table 5.1 Overview of factory gas settings

5 Start-up

5.2.2 Checking the connection pressure (gas flow pressure)

To check the connection pressure, proceed as follows (cf. fig. 5.3):

- Take the front casing off the appliance.
- Close the appliance's gas stop cock.
- Unscrew the seal plug (1) marked "in" on the gas fitting.
- Connect a digital pressure gauge or U-pipe pressure gauge (2).
- Open the appliance's gas stop cock.
- Start up the appliance.
- Measure the connection pressure against the atmospheric pressure.

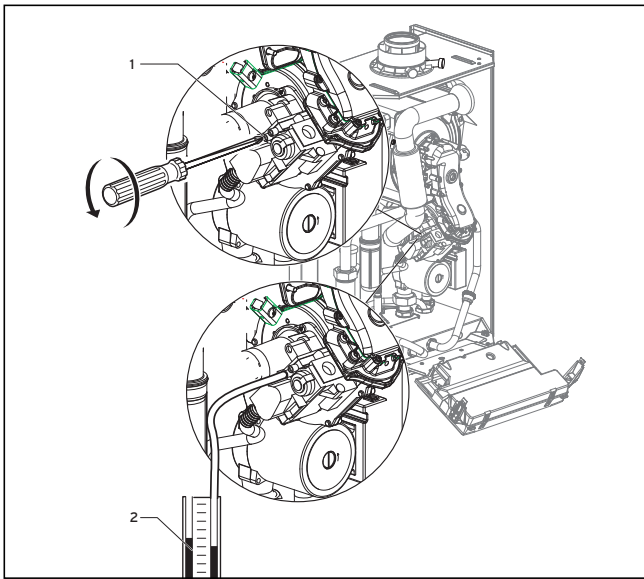


Fig. 5.3 Measuring the connection pressure



Caution!

Natural gas:

If the connection pressure lies outside the range from 17 to 25 mbar, you mustn't make a setting or start up the appliance.

Liquid gas:

If the connection pressure lies outside the range from 47.5 to 57.5 mbar, you mustn't make a setting or start up the appliance.

If the connection pressure lies within the permissible range, proceed as follows:

- Put the appliance out of operation.
- Close the appliance's gas stop cock.
- Remove the pressure gauge and screw the seal plug (1) back on.
- Open the appliance's gas stop cock.
- Check that the seal plug is fit tight.
- Put the front casing back on and start the appliance up again.

If the connection pressure does not lie within the permissible range and you can't correct the error, notify the gas supplier. Proceed as follows:

- Put the appliance out of operation.
- Close the appliance's gas stop cock.
- Remove the pressure gauge and screw the seal plug (1, fig. 5.3) back on.
- Check that the seal plug is fit tight.
- Put the front casing back on.

Do not start up the appliance!

5.2.3 Checking the CO₂ content and adjusting it if needed (air ratio setting)

- Take off the appliance casing.
- Activate test program P.1:
- Press "Mains ON" or press the reset key.
- Now press the "+" key until P.0 appears in the display (approx. 5 s).
- Then press the "+" key once. The display shows P.1.
- The test program P.1 is started by pressing the "i" key.

The appliance then runs for 15 minutes at full power.

- Wait at least 5 minutes until the appliance reaches operating temperature.
- Measure the CO₂ content at the flue gas test nozzle (3) (fig. 5.4). Compare the value measured with the corresponding value in table 5.2.
- If a setting of the flue gas value is necessary, unscrew the screw (4) and move the air intake pipe (5) forward by 90°.

Do not remove the air intake pipe!

- If necessary, set the corresponding flue gas value (table 5.2) by turning the screw (6).



Note!

Natural gas:

Adjust only in 1/8 of a full revolution increments and wait about a minute after every adjustment until the value becomes stable.

Liquid gas:

Adjust only in very small increments (approx. 1/16 of a full revolution) and wait about a minute after every adjustment until the value becomes stable.

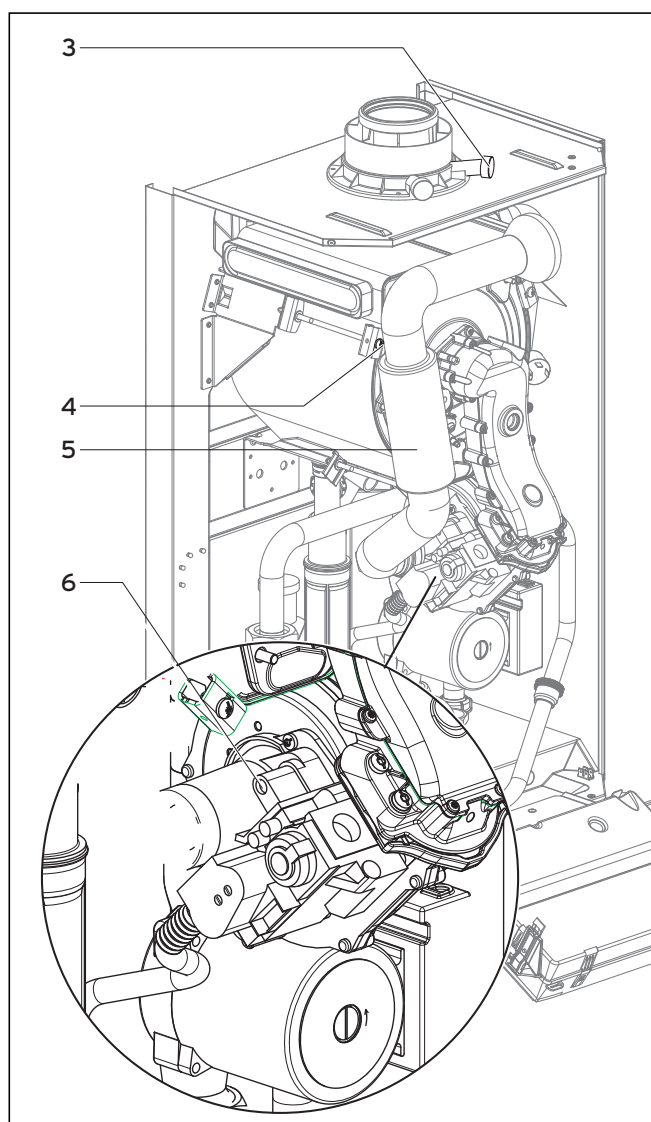


Fig. 5.4 Carrying out a CO₂ measurement, carrying out an air ratio setting (gas setting)

- Turn to the left (anti-clockwise):
higher CO₂ content
- Turn to the right (clockwise):
lower CO₂ content
- After the setting procedure, put the air intake pipe back up.
- Check the CO₂ content again.
- If necessary, repeat setting.
- Quit the P.1 test program by pressing the "+" and "i" keys simultaneously. The measuring operation is also quit when no key has been pressed for 15 minutes.
- Screw the screw (4) in.
- Put on the appliance casing.

Settings	Natural gas H tolerance	Unit
CO ₂ after 5 minutes full-load operation	8.8 +/- 1.0	Vol. %
set for Wobbe index Wo	15	kWh/m ³

Table 5.2 Factory gas setting

5.3 Functional test

After installing the appliance and setting the gas, perform a functional test before commissioning the appliance and handing it over to the user.

- Commission the appliance in accordance with the instructions in the relevant operating manual.
- Check the appliance for gas and water leaks.
- Check the flue system for leaks and that it is fixed properly.
- Check over-ignition and that the flame on the burner is burning evenly.
- Check that the heating and hot water generation are working properly.
- Pass the appliance on to the user.

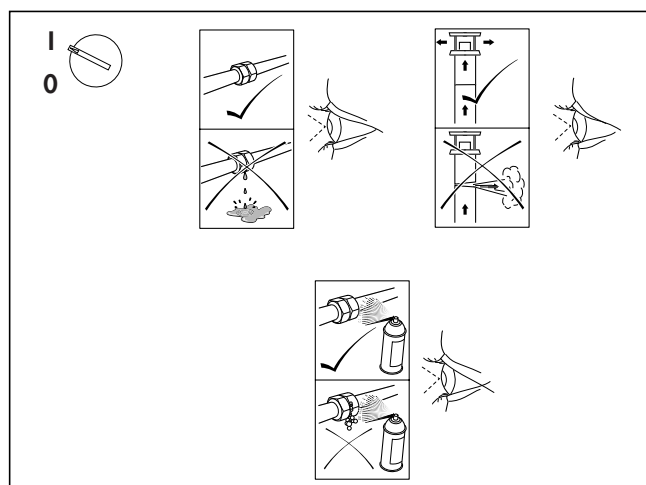


Fig. 5.5 Functional test

The Vaillant ecoMAX 646 possesses status codes that display the operating status of the appliance in the DIA system display. A functional test of the hot water operation and heating operation can be carried out using these status codes by pressing the "i" key.

5 Start-up

Recharging

- Switch on the appliance and the connected hot water cylinder.
- Make sure that the cylinder thermostat is requesting heat.
- Press the "i" key.

When the cylinder is correctly charged, the status code "S.24" appears in the display.

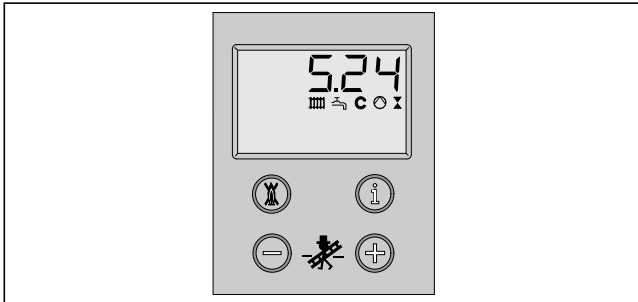


Fig. 5.6 Display during recharging

Heating

- Switch on the appliance.
- Make sure that heat is being requested.
- Press the "i" key.

When the heating is running correctly, the status code "S.4" appears in the display.

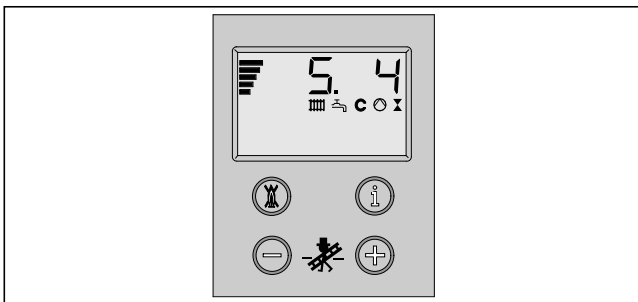


Fig. 5.7 Display during heating mode

5.4 Instructing the user

The user of the heating system must be instructed about its functions and how to operate it. The following measures in particular are to be carried out here:

- Hand over any instructions intended for the user as well as the appliance documentation.
- Inform the user that the instruction manuals should be kept near the appliance.



Note!

When you have finished the installation, attach the sticker supplied (835593) to the appliance in the user's language.



Caution!

The appliance may only be used

- for initial operation
 - for testing
 - for continuous operation
- with the chamber cover closed and with the flue system fully mounted and sealed.**

5.4.1 Instructing the user about the heating system

- Instruct the user about the methods used for combustion air supply and flue conducting. Be especially sure to point out that these must not be altered.
- Instruct the user on how to check the required water level/filling pressure of the system as well as on methods of refilling and bleeding the heating system when needed.
- Point out to the user the correct (economical) settings for temperatures, controllers and thermostat valves.
- Instruct the user on the need for yearly inspection and maintenance of the system. Recommend making a maintenance contract.

5.4.2 Vaillant warranty

Vaillant provide a full parts and labour warranty for this appliance. The appliance must be installed by a suitably competent person in accordance with the Gas Safety (Installation and Use) Regulations 1998, and the manufacturer's instructions. In the UK 'CORGI' registered installers undertake the work in compliance with safe and satisfactory standards.

All unvented domestic hot water cylinders must be installed by a competent person to the prevailing building regulations at the time of installation. (G3) Terms and conditions apply to the warranty, details of which can be found on the warranty registration card included with this appliance.

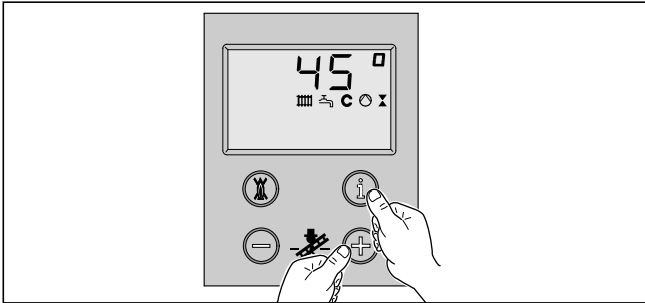
Failure to install and commission this appliance in compliance with the manufacturer's instructions may invalidate the warranty (this does not affect the customer's statutory rights).

6 Adapting the appliance to the heating system

6.1 Setting partial-load heating

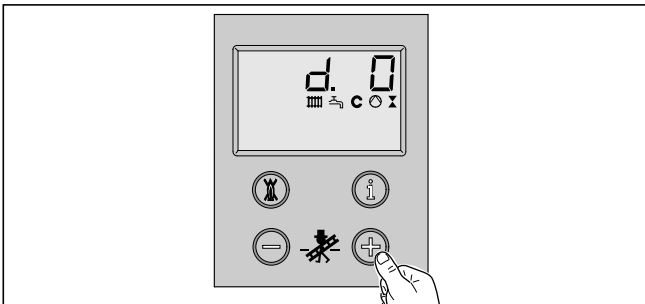
The appliances are set in the factory to the thermal load shown in table 6.1. If you want to set a different load, proceed as follows:

- Press the "i" and "+" keys simultaneously.



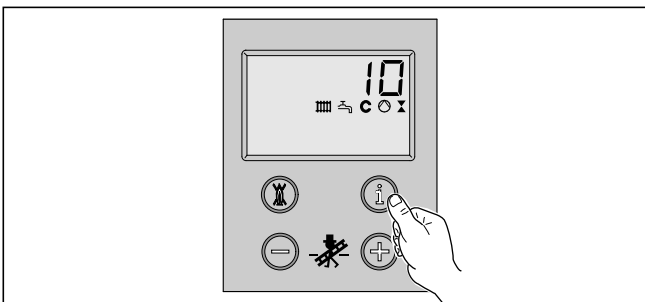
- Continue to hold the "+" key down until "d.0" appears in the display.

The display runs from "d.0" through to "d.99" and starts again at "d.0".



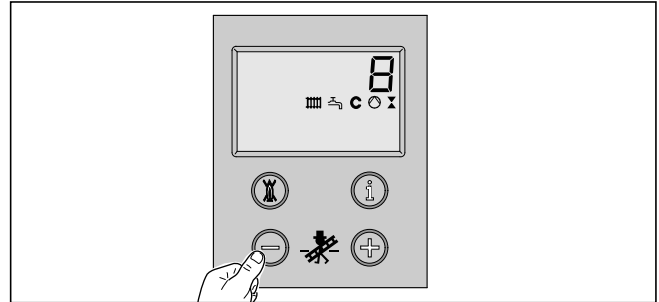
- Press the "i" key.

The "=" symbol appears in the display. Then the set partial load is displayed in kW.



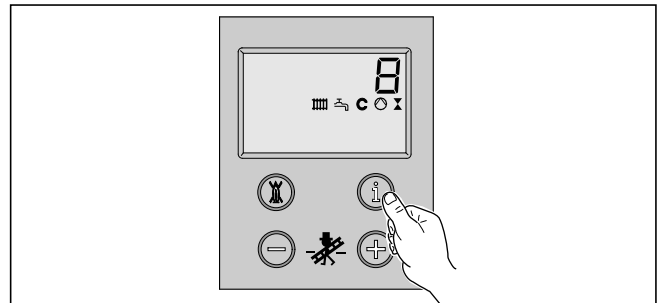
- By pressing the "+" or "-" keys you can now increase or decrease the value in 1 kW increments.

The displayed value flashes during the setting procedure. The possible setting ranges are to be found in table 6.1.



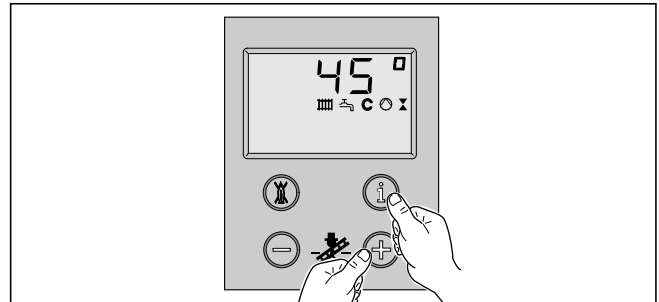
- Then hold down the "i" key for approx. 5 s until the display no longer flashes.

The value is now saved. The standard display appears again in the display (current heating supply temperature, e.g. 45 °C).



- Quit the setting mode by pressing the "i" and "+" keys simultaneously.

The setting mode is also quit if you do not touch a key for 4 minutes.



Appliance type	Setting range in kW	Factory setting in kW
ecoMAX 646	12 - 45	35

Table 6.1 Setting range for partial-load heating

6 Adapting the appliance to the heating system

6.2 Setting the pump run-out time

The pump run-out time for the heating mode is set to 5 minutes in the factory. It can be varied within a range from 1 minute to 60 minutes or be in "continuous" mode. In order to change the pump run-out time, proceed as follows:

- Pull the front panel of the appliance outwards.
- Switch the appliance main switch to the "I" position.
- Press the "i" and "+" keys simultaneously and hold down the "+" key until "d.1" appears in the display.
- Press the "i" key.

The current pump run-out time in minutes appears in the display.

- By pressing the "+" or "-" keys you can now increase or decrease the value.

To set the pump mode "continuous", do not enter a number, rather select the symbol "--" with the "+" or "-" key.

- Hold down the "i" key for about 5 seconds until the display stops flashing.

The value is now saved.

- Quit the setting mode by pressing the "i" and "+" keys simultaneously.

The standard display appears again in the display (current heating supply temperature, e.g. 45 °C).

The setting mode is also quit if you do not touch a key for 4 minutes.

6.3 Setting the pump output

6.3.1 Setting the pump output with direct feeding

The operating mode of the pump is factory set to "auto" (diagnosis point d.14 = 0).

6.3.2 Setting the pump output with hydraulic decoupling

Proceed as described in chapter 4.2.2.

6.4 Setting the burner lockout time

In order to avoid frequent switching on and off of the burner (energy loss), an electronic block on it switching back on is activated for a certain time after every time it has been switched off. The burner lockout time can be adjusted to fit the characteristics of the heating system. The burner lockout time is only activated for the heating mode. Hot water operation during a burner lockout time in progress does not affect the timer.

The maximum burner lockout time can be set under diagnosis point d.2 between 2 and 60 minutes (factory setting: 20-minutes). The lockout time effective in each case is then automatically calculated from the current set supply temperature and the set maximum burner lockout time.

The timer can be reset or deleted by pressing the appliance main switch. The burner lockout time remaining in

the heating mode after a control shutdown can be viewed under diagnosis point d.67.

In order to change the lockout time, proceed as follows:

- Pull the front panel of the appliance outwards.
- Switch the appliance main switch to the "I" position.
- Press the "i" and "+" keys simultaneously and hold down the "+" key until the diagnosis code "d.2" appears in the display.
- Press the "i" key.

The symbol "=" now appears in the display and then the current burner lockout time in minutes.

- By pressing the "+" or "-" keys you can now increase or decrease the value in 1 minute increments.

The displayed value flashes during the setting procedure.

- Hold down the "i" key for about 5 seconds until the display stops flashing.

The value is now saved.

- Quit the setting mode by pressing the "i" and "+" keys simultaneously.

The standard display appears again in the display (current heating supply temperature, e.g. 45 °C).

The setting mode is also quit if you do not touch a key for 4 minutes.

7 Inspection and maintenance

7.1 Inspection and maintenance intervals

Appropriate, regular inspections and maintenance and the exclusive use of original spare parts are the decisive factors in determining whether your Vaillant ecoMAX 646 will run problem-free and have a long service life.



Danger!

Inspections/Maintenance work not carried out can result in material damage and injury to persons.

For this reason, we recommend the signing of an inspection and/or maintenance contract. The inspection is intended to determine the actual condition of an appliance and compare it with the specified condition. This is done by measuring, checking, observing. Maintenance is required in order to eliminate any deviations of the actual condition from the specified condition. This is usually done by cleaning, setting and, if necessary, replacing individual components subject to wear. With regard to the Vaillant ecoMAX 646, this means it is usually sufficient to conduct an inspection once a year. Inspections can be performed quickly and economically without dismantling any components thanks to the data query in the DIA system, easy optical inspection and an air ratio measurement. Experience indicates that under normal circumstances it is not necessary to clean the burner and heat exchangers yearly. These maintenance intervals and their extent are determined by a specialist, depending on the ascertained condition of the appliance during the inspection. All inspection and maintenance work should be performed in the order specified in table 7.1.

7.2 Inspection and maintenance instructions

Only genuine Vaillant spare parts may be used for inspections, maintenance and repair work to ensure the perfect long-term working order of all functions of your Vaillant appliance and to prevent the permitted series condition from being changed. Any spare parts which might be required are listed in the relevant current spare parts catalogues. Information can be obtained from Vaillant Customer Service Centres.



Note!

If inspection and maintenance work is necessary with the mains switch on, this is indicated in the description of the maintenance work.



Danger!

The supply terminals of the appliance are under voltage even if the mains switch is off.

No.	Step	To be carried out during:	
		Inspection	Maintenance
1	Disconnect the appliance from the mains supply, close the gas supply and maintenance cocks, depressurize the appliance on the water side (observe the pressure gauge)		X
2	Dismantle compact thermal module		X
3	Clean the integral condensation heat exchanger		X
4	Check whether the burner is dirty		X
5	Install compact thermal module. Caution: replace the seals!		X
6	Check whether the electrical plug connections and other connections are fitted tightly, and make adjustments if necessary	X	X
7	Check the primary pressure at the expansion tank, and adjust it if necessary		X
8	Clean the air barrel		X
9	Open the maintenance cocks and fill the appliance/system up to about 1.0 - 2.0 bar (depending on the static height of the system); start the bleeding program		X
10	Check the overall condition of the appliance, remove general dirt from the appliance and the vacuum chamber	X	X
11	Check the condensate siphon in the appliance, and clean and fill it if necessary	X	X
12	Clean the condensate paths in the appliance		X
13	Open the gas supply and switch on the appliance	X	X
14	Carry out a test operation on the appliance and heating system including water heating, and bleed if necessary	X	X
15	Test ignition and burner performance	X	X
16	Check whether the appliance is leaking flue gas, water or condensate	X	X
17	Check the flue system for leaks and that it is fixed properly, and make adjustments if necessary	X	X
18	Check appliance gas setting, and reset and record if necessary		X
19	Service the hot water cylinder (if present): rinse the inner tank, check the magnesium protection anode for abrasion, replace after a max. of 5 years	X	X
20	Keep a log of the inspection/maintenance carried out	X	X

Table 7.1 Maintenance steps

7 Inspection and maintenance

Always perform the following steps prior to maintenance work:

- Switch off the mains switch.
- Disconnect the appliance from the mains supply by de-energising the appliance by means of a separator with a contact opening of at least 3-mm (e.g. fuses or circuit breakers).
- Close the gas shut-off valve.
- Close the heating supply and return and the cold water inlet valve.
- Take the front casing off the appliance.

Always perform the following steps after performing any maintenance work:

- Open the heating supply and return and the cold water inlet valve.
- Refill the appliance, if necessary, on the hot water side up to a pressure of between 1.0 and 2.0 bar and bleed the heating system (see chapter 5.1).
- Open the gas shut-off cock.
- Reconnect the device to the mains supply and switch on the mains switch.
- Check the appliance for gas and water leaks.
- If necessary, refill and re-bleed the heating system.
- Put on the appliance's front casing.

7.2.1 Servicing the compact thermal module

Dismantling the compact thermal module

The compact thermal module consists of a speed-controlled fan, combined gas/air fittings, the gas supply (mixer tube) for the fan of the pre-mixing burner and the pre-mixing burner itself. These four components make up the complete assembly that is the compact thermal module. Proceed as follows to dismantle it: (see fig. 7.1)



Danger!

There is danger of being injured or scalded at the compact thermal module and at all components carrying water. Only work on the components once they have cooled down. The mixer tube (7) between gas control unit and burner may not be opened. It can only be guaranteed that this component is gas-tight after it has been inspected at the factory.

- Cut off the gas supply to the appliance.
- Lower the switch cabinet.
- Undo the fastening screw of the air intake pipe (5) and lift the air intake pipe forward (3); remove the air intake pipe from the intake socket.
- Pull the two plugs of the ignition and grounding lines off the ignition electrode (6).
- Undo the gas supply line (10) on the underside of the gas fitting (fig. 7.2).
- Pull the cables (9) off the fan motor and the cable (8) off the gas fitting.
- Undo the five nuts (2).



Caution!

Under no circumstances may the compact thermal module be suspended from the flexible corrugated gas pipe.

- Pull the entire compact thermal module (4) off the integral condensation heat exchanger (1).

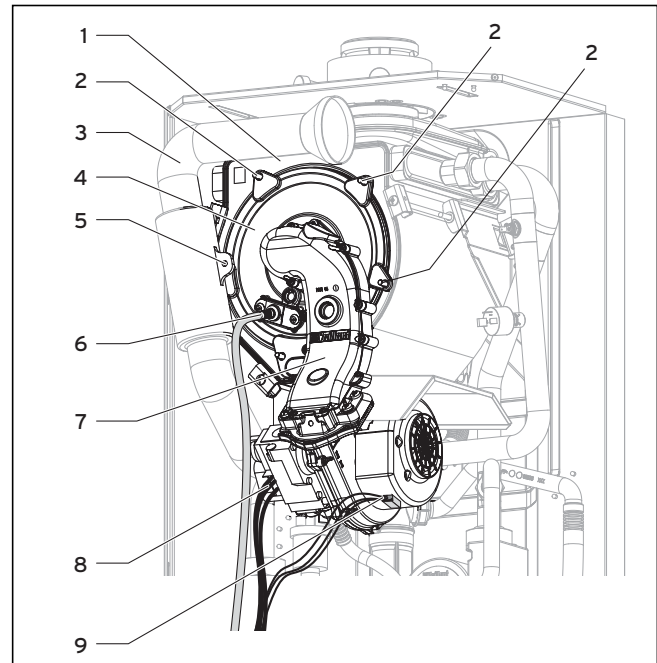


Fig. 7.1 Dismounting/Mounting the compact thermal module

Mounting the compact thermal module



Danger!

The two silicon seals (1) on the compact thermal module (fig. 7.3) (SP no. 98-1046) must be replaced every time maintenance is carried out. The burner flange insulation (2) on the compact thermal module (fig. 7.3) (SP no. 21-0734) must not show any signs of damage; if it does, it must also be replaced.

- Put the compact thermal module (4) onto the integral condensation heat exchanger (1) (fig. 7.1).
- Tighten the five nuts (2) evenly and crosswise.
- Put the air intake pipe (3) onto the intake socket and tighten the screw (5).
- Connect the gas supply line (10) with a new seal (SP no. 98-0012) to the gas fitting (fig. 7.3). Use the spanner flat at the flexible gas line to hold the gas fitting.
- Connect the two plugs of the ignition and grounding lines to the ignition electrode (6).
- Connect the cables (9) to the fan motor and the cable (8) to the gas fitting.
- Open the gas supply to the appliance.



Danger!
Check the gas connection (10) for leaks with leak spray (fig. 7.2).

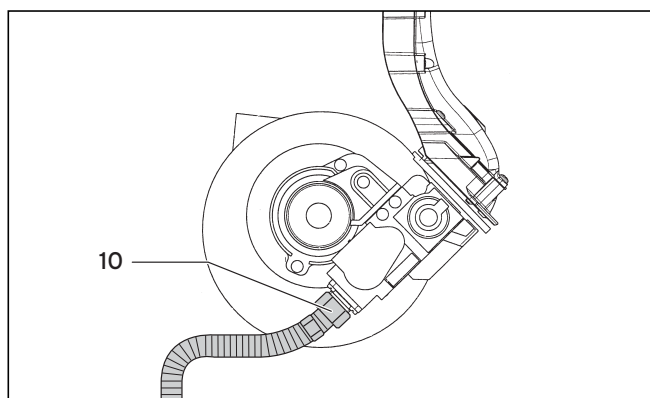


Fig. 7.2 Gas connection

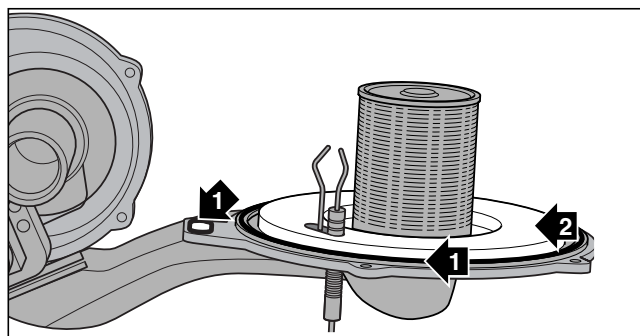


Fig. 7.3 Checking seals and burner flange insulation

7.2.2 Cleaning the integral condensation heat exchanger



Caution!
Protect the lowered electronics box against spray water.

- Dismantle the compact thermo module as described under 7.2.1.
- Clean the heating spiral (1) of the integral condensation heat exchanger (2) using regular vinegar essence (fig. 7.3). Rinse with water.
- The condensate receptacle can also be cleaned via the opening (3).
- After an action time of approx. 20 minutes, rinse off the dust particles that have come loose with a powerful water jet.

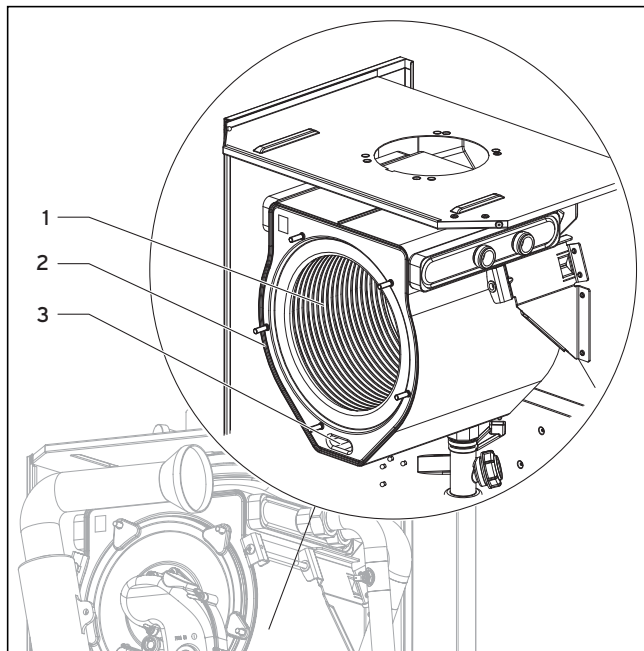


Fig. 7.4 Cleaning the integral condensation heat exchanger

7.2.3 Checking the burner

The burner is maintenance-free and needs no cleaning. The surface should be checked for damage, and the burner replaced if necessary.

- After checking/replacing the burner, install the compact thermo module as described in 7.2.1.

7.2.4 Cleaning the condensate siphon

- Screw off the bottom (3) of the condensate siphon (see fig. 7.5).
- Clean the bottom of the siphon by rinsing it out with water.
- Then fill the bottom about 3/4 full with water.
- Screw the bottom back on the condensate siphon.



Danger!
If the appliance is operated with an empty condensate siphon, there is the danger of poisoning through escaping flue gases. Therefore, refill the siphon after each cleaning.

7.2.5 Cleaning the condensate paths

To clean the condensate paths, the complete condensate siphon can be taken off by pulling out the clips (1). Then the two condensate discharges on the heat exchanger are accessible.

Dirt accretions in the front condensate discharge area can be removed via the lower cleaning hole (2).

7 Inspection and maintenance

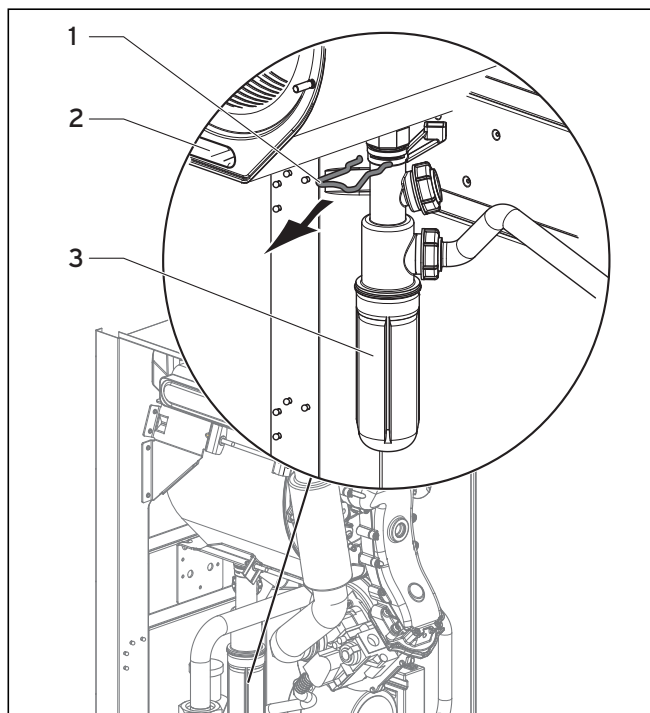


Fig. 7.5 Cleaning the condensate paths

7.3 Checking the gas setting

Perform a gas setting check as described in chapter 5.2.

7.4 Filling and bleeding the system

Proceed as described in points 5.1.2 and 5.1.3.

7.5 Draining the appliance and the system

7.5.1 Draining the appliance

- Close the appliance's maintenance cocks.
- Open the drain valve in the return.
- Open the air-release valve on the cylinder supply in order for the appliance to be completely drained.

7.5.2 Draining the entire system

- Attach a hose to the system's drain point.
- Bring the open end of the hose to a suitable discharge point.
- Make sure that the boiler's maintenance cocks are open.
- Open the draining cock.
- Open the air-release valves on the radiators. Start with the radiator that is highest up and then continue downward.
- When the water has run out, close the radiators' exhausts and the draining cock again.

7.5.3 Cleaning the air barrel



Danger!

There is danger of being injured or scalded at all components carrying water. Only carry out work on these components once they have cooled down.

- Dismount the air barrel as shown in fig. 7.6 and rinse it with hot water.
- Remount the air barrel and make sure to use new seals (SP no. 981272).

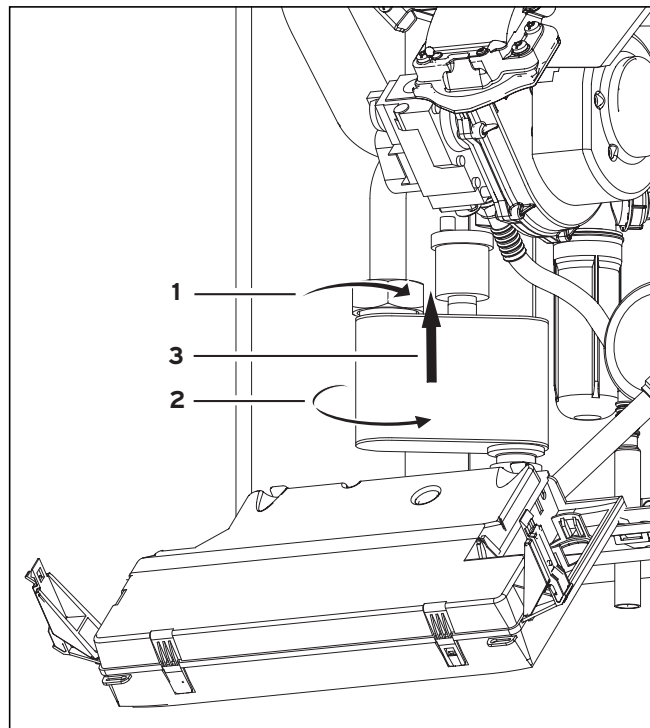


Fig. 7.6 Cleaning the air barrel

7.6 Test operation

After the maintenance work has been completed, carry out a functional test (see chapter 5.3).

8 Troubleshooting

8.1 Diagnostics

8.1.1 Status codes

The status codes, which you get via the DIA system's display, give you information about the appliance's current operating status.

If several operating statuses exist simultaneously, the most important status code is always shown.

The display of the status codes can be viewed as follows:

- Press the "i" key beneath the display.
The status code appears in the display, e.g. S.04 for "Burner mode - heating".

The display of the status codes can be ended as follows:

- Press the "i" key beneath the display
or
- do not press any key for about 4 minutes. The current heating supply temperature appears in the display again.

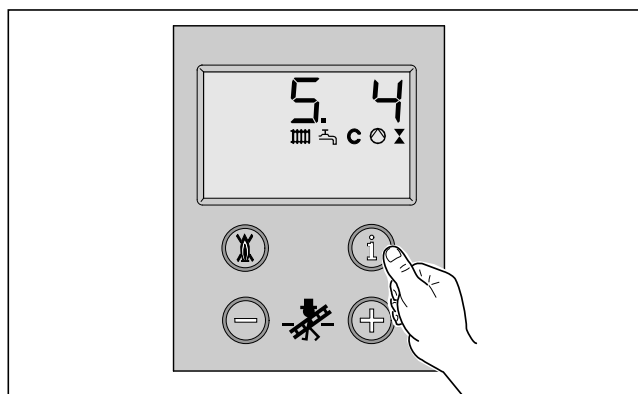


Fig. 8.1 Display of status codes

Code	Meaning
S. 0	No heat required
S. 1	Heating pump supply
S. 2	Heating fan start
S. 3	Heating ignition
S. 4	Heating burner on
S. 5	-
S. 6	Heating fan run-out
S. 7	Heating pump run-out
S. 8	Remaining lockout time heating
S. 10	Hot water request
S. 11	Hot water fan start
S. 13	Hot water ignition
S. 14	Hot water burner on
S. 15	-
S. 16	Hot water fan run-out
S. 17	Hot water pump run-out
S. 20	Hot water cycle mode
S. 21	Hot water fan start
S. 23	Hot water ignition
S. 24	Hot water burner on
S.25	-
S. 26	Hot water fan run-out
S. 27	Hot water pump run-out
S. 28	Hot water lockout time
S. 30	No heat requirement controller (2-point controller)
S. 31	Summer mode
S. 32	Waiting time fan
S. 34	Heating frost protection
S. 36	No heat requirement controller (continuous controller)
S. 37	Waiting time fan
S. 39	Feed thermostat contact open
S. 42	Flue gas flap no feedback
S. 53	Waiting time lack of water (burner on ΔT VL-RL was > 40 K; burner off ΔT VL-RL was > 45 K)
S. 54	Waiting time lack of water

Table 8.1 Status codes

8 Troubleshooting

8.1.2 Diagnosis codes

In the diagnosis mode, you can change certain parameters or display more information (see following table).

- Press the "i" and "+" keys under the display simultaneously.

The display shows "d.0".

- Scroll to the desired diagnosis number with the "+" or "-" buttons.
- Press the "i" key.

The display shows the relevant diagnosis information.

- If necessary, use the "+" or "-" keys to change the value (display flashes).
 - Save the new value by holding down the "i" key for approx. 5 seconds until the display no longer flashes.
- You can end the diagnosis mode as follows:
- Press the "i" and "+" keys simultaneously or
 - do not press any key for about 4 minutes. The current heating supply temperature appears in the display again.

Code	Meaning	Display value/adjustable value
d. 0	Partial-load heating	adjustable values in kW
d. 1	Pump run-out heating	1 - 60 minutes or "continuous" (factory setting: 5 minutes)
d. 2	Max. lockout time heating	1 - 60 minutes (factory setting: 20 minutes)
d. 3	With use of solar energy: collector temperature actual value	actual value in °C
d. 4	Cylinder temperature actual value	actual value in °C; with use of solar energy: actual value of the upper cylinder temperature sensor
d. 5	Supply temperature target value	target value in °C
d. 6	Cylinder temperature target value	target value in °C
d. 7	Cylinder temperature target value for VC appliances	target value in °C
d. 8	Terminal 3-4	0 = room thermostat open (no heating operation) 1 = room thermostat closed (heating operation)
d. 9	Terminal 7-8-9 target value	in °C (continuous controller)
d. 10	Internal pump	1 = on; 0 = off
d. 11	External pump	1 = on; 0 = off
d. 12	Storage charging pump	1 = on; 0 = off
d. 13	Circulation pump	1 = on; 0 = off
d. 14	Pump speed target value	target value internal pump in %. Possible settings: factory setting auto, 53, 60, 70, 85, 100 %
d. 15	Pump speed actual value	actual value internal pump in %
d. 16	Pump 2	1 = circulation pump; 2 = external pump; 3 = storage charging pump; 4 = solar pump
d. 17	Control type:	0 = supply temperature control; 1 = return temperature control
d. 22	Hot water request:	1 = on; 0 = off
d. 23	Operating mode	summer/winter mode: 1 = on; 0 = off
d. 24	Air pressure sensor actual value	actual value in Pa
d. 25	Hot water enabling via warm restart clock	1 = yes; 0 = no
d. 33	Fan target value	target value in upm/10
d. 34	Fan actual value	actual value in upm/10
d. 40	Supply temperature actual value	actual value in °C
d. 41	Return temperature actual value	actual value in °C
d. 42	Solar cylinder temperature actual value	actual value in °C; with use of solar energy: actual value of the lower cylinder temperature sensor
d. 44	Ionisation current actual value	actual value/100 in µA
d. 46	External temperature correction value	correction value in K
d. 47	External temperature actual value	actual value in °C
d. 50	Minimum speed offset	in upm/10
d. 51	Maximum speed offset	in upm/10
d. 52	Minimum air pressure offset	in Pa
d. 53	Maximum air pressure offset	in Pa
d. 60	Number of temperature limiting shutdowns	number
d. 61	Safety thermostat shutdown	number
d. 67	Remaining lockout time heating	in minutes
d. 68	No first start number	number of failed ignitions in the first attempt
d. 69	No second start number	number of failed ignitions in the second attempt
d. 71	Max. supply temperature heating	max. target value of the heating supply temperature: adjustable value 40 - 85 °C (factory setting: 75 °C)
d. 72	Pump run-out hot water	pump run-out time in seconds after the charging of a hot water cylinder; factory setting: 80 s
d. 73	Activation difference for solar pump	recommended setting when using solar energy: +7 °C.
d. 75	Max. charging time hot water cylinder	maximum charging time for a cylinder without its own controller
d. 76	Appliance variants	1 - 17
d. 77	Partial-load hot water cylinder	limitation of the storage charging output in kW
d. 78	Max. supply temperature hot water when using solar energy: scalding protection temperature	limitation of the storage charging temperature in °C when using solar energy: temperature at which the solar pump is switched off.
d. 80	Operating hours heating	in h
d. 81	Operating hours hot water generation	in h
d. 82	Burner starts - heating	number of hystereses in the heating mode x 100
d. 83	Burner starts - hot water mode	number of hystereses in the hot water mode x 100

Table 8.2 Diagnosis codes

8.1.3 Error codes

The error codes displace all other displays when errors occur. An error that arises is shown in the display as "F...", e.g. "F.10" (see table on the next page). If several errors occur simultaneously, the corresponding error codes are displayed alternately for approx. 2 seconds each.

- Press the "i" and "-" keys simultaneously.
- You can scroll back through the error memory by pressing the "+" key.

You can exit the error memory display as follows:

- Press the "i" key beneath the display or
- do not press any key for about 4 minutes.

8.1.4 Error memory

The last 10 errors are saved in the appliance error memory.

The current heating supply temperature appears in the display again.

Code	Meaning	Cause
F. 0	Interruption supply sensor	NTC-connector not plugged in or loose, NTC defective, multi-plug on the electronics not plugged in properly
F. 1	Interruption return sensor	NTC-connector not plugged in or loose, NTC defective, multi-plug on the electronics not plugged in properly
F. 10	Short circuit supply sensor	NTC defective, short-circuit to ground/short circuit in the cable harness
F. 11	Short circuit return sensor	NTC defective, short-circuit to ground/short circuit in the cable harness
F. 13	Short circuit cylinder sensor	NTC defective, short-circuit to ground/short circuit in the cable harness, inside of the plug damp
F. 20	Water safety thermostat	supply or return NTC defective (intermittent contact), supply temperature too high, earth connection of the cable harness to the appliance not correct, failed discharge to the electrode via ignition cable, ignition plug or ignition electrode
F. 22	Dry burning (no water in the appliance)	no water in the primary heat exchanger during commissioning, RESET activated while the appliance is hot, water pressure switch has been triggered
F. 23	No water in the appliance, water shortage, temperature spread too large, system not bled correctly	pump jammed, reduced output of the pump, air in the appliance, system pressure too low, supply and return NTC mixed up, appliance not filled via appliance-internal KFE cock (fill only via return!), start bleeding program
F. 24	Water shortage Temperature rise too quick System not bled correctly	pump jammed, reduced output of the pump, air in the appliance, system pressure too low, supply and return NTC mixed up, start bleeding program, appliance not filled via return
F. 25	Flue gas safety thermostat flue gas temperature too high System pressure too low	plug connector option flue gas safety thermostat interrupted water pressure switch has been triggered
F. 27	Flame simulation (flame signal despite gas valve being switched off)	gas solenoid valve leaking, electronics (flame detector defective, dampness on the electronics)
F. 28	No ignition when starting	no or too little gas, ignition system (ignition transformer, ignition cable, ignition plug) defective, interruption of the ionisation current (cable, electrode), false gas setting, faulty earthing of the appliance, electronics defective
F. 29	No reignition	gas supply temporarily interrupted, flue gas recirculation, faulty earthing of the appliance
F. 32	Speed deviation fan (too large when starting)	fan jammed, plug to fan not plugged in correctly, error in the cable harness, electronics defective
F. 37	Speed deviation fan (too large or small during operation)	pressure sensor not fitted or defective (however, not short circuit or interruption)
F. 42	Short circuit coding resistance	no valid value for appliance variant
F. 43	Interruption coding resistance	no valid value for appliance variant
F. 60	Gas valve control "+" faulty	short circuit/short-circuit to ground in the cable harness to the gas valves, gas fitting defective (short-circuit to ground of the coils), electronics defective
F. 61	Gas valve control "-" faulty	short circuit/short-circuit to ground in the cable harness to the gas valves, gas fitting defective (short-circuit to ground of the coils), electronics defective
F. 62	Gas valve shut-off faulty	gas fitting leaking, electronics defective
F. 63	EEPROM faulty	electronics defective
F. 64	Electronics/sensor fault	short circuit supply or return NTC, electronics defective
F. 65	Electronics temperature too high	electronics too hot due to external influence, electronics defective
F. 67	Electronics error flame (implausible flame signal)	electronics defective
Emergency run "speed"	Special message: no speed signal from the fan	fan (hall sensor) defective, error in the cable harness, electronics defective

Table 8.3 Error codes

8 Troubleshooting

9 Vaillant service

10 Recycling and disposal

8.1.5 Test programs

Special functions can be triggered in the appliances by activating various test programs. These programs are given in detail in the following table 8.5.

- The test programs P.0 to P.6 are started when "Power ON" is turned on and the "+" key is pressed for 5 s.

The display shows "P.1".

- Press the "+" key to start counting the test number upwards.
- By pressing the "i" key the appliance is now put into operation and the test program started.
- Press "i" and "+" simultaneously to end the test programs. You can also end the test programs by not pressing any key for 15 minutes.

Display	Meaning
P. 0	Bleeding test program 1x "i" key: start bleeding the heating pump (display: HP) 2x "i" key: start bleeding the charging pump (display: LP) 3x "i" key: end bleeding program Note: the bleeding program runs for approx. 6.5 mins.
P. 1	Test program whereby the appliance is operated at full load after successful ignition
P. 2	Test program whereby the appliance is operated with minimum gas volume after successful ignition
P. 5	Test program for safety thermostat test; appliance heats up by bypassing a control shutdown until the safety thermostat shutdown temperature of 97 °C is reached

Table 8.5 Test programs

9 Vaillant Service

To ensure regular servicing, it is strongly recommended that arrangements are made for a Maintenance Agreement.

Please contact Vaillant Service Solutions (0870 6060 777) for further details.

10 Recycling and disposal

Recycling and disposal have already been taken into account during the development of all Vaillant products. Vaillant's standards lay down strict requirements. When selecting materials, the recyclability, dismantability and separability of materials and components are taken into account, just as environmental hazards and health risks during recycling and the disposal of unavoidable remains of unusable residue are.

10.1 Appliance

Your Vaillant ecoMAX 646 consists 92 % of metallic materials which can be melted down again at iron and steel works and therefore can be recycled practically any number of times. The plastic materials used are labelled and, in this way, are already prepared for sorting and fractionation for subsequent recycling.

10.2 Packaging

Vaillant has reduced the transport packaging of the appliances to a minimum. The strict selection of the packaging materials is based on their recyclability. The high-quality cardboard articles are secondary raw materials which have been in demand in the cardboard and paper industry for a long time.

EPS (polystyrene)[®] is used to protect the products during transport. EPS is 100 % recyclable and CFC-free. Even the films and tightening bands are made of recyclable plastic.

11 Technical data

ecoMAX	646	Unit
nominal heat output range P (heating 40/30 °C)	13.3 - 47.7	kW
nominal heat output range P (heating 50/30 °C)	12.9 - 46.4	kW
nominal heat output range P (heating 60/40 °C)	12.5 - 45.0	kW
nominal heat output range P (heating 80/60 °C)	12.3 - 44.1	kW
storage charging output Pw	44.1	kW
max. thermal load Q during heating operation	45.0	kW
max. thermal load Q during recharging	45.0	kW
min. thermal load	12.5	kW
NOx class	5	–
connection pressure (gas flow pressure) natural gas, p _ü	20	mbar
connection pressure (gas flow pressure) propane, p _ü	50	mbar
flue gas mass flow min./max.	5.7/20.5	g/s
flue gas temperature min./max.	40/70	°C
rated water volume (when $\Delta T = 20 \text{ K}$)	1935	l/h
residual delivery head of the pump (without gravity brake)	280	mbar
residual delivery head of the pump (with gravity brake)	190	mbar
max. supply temperature approx.	85	°C
permissible operating overpressure on the heating side (PMS)	3.0	bar
min. required total overpressure on the heating side	0.8	bar
condensate volume (pH value: 3.0-4.0)	4,5	l/h
mounting weight	45	kg
height	800	mm
width	480	mm
depth	450	mm
electrical connection	230/50	V/Hz
electrical power consumption min./max. (with integrated pump)	138/180	W
type of protection	IP X4 D	–



BENCHMARK No. | | | | | | |

GAS BOILER COMMISSIONING CHECKLIST

BOILER SERIAL No. _____ NOTIFICATION No. _____

CONTROLS To comply with the Building Regulations, each section must have a tick in one or other of the boxes

TIME & TEMPERATURE CONTROL TO HEATING	ROOM T/STAT & PROGRAMMER/TIMER <input type="checkbox"/>	PROGRAMMABLE ROOMSTAT <input type="checkbox"/>
TIME & TEMPERATURE CONTROL TO HOT WATER	CYLINDER T/STAT & PROGRAMMER/TIMER <input type="checkbox"/>	COMBI BOILER <input type="checkbox"/>
HEATING ZONE VALVES	FITTED <input type="checkbox"/>	NOT REQUIRED <input type="checkbox"/>
HOT WATER ZONE VALVES	FITTED <input type="checkbox"/>	NOT REQUIRED <input type="checkbox"/>
THERMOSTATIC RADIATOR VALVES	FITTED <input type="checkbox"/>	
AUTOMATIC BYPASS TO SYSTEM	FITTED <input type="checkbox"/>	NOT REQUIRED <input type="checkbox"/>

FOR ALL BOILERS CONFIRM THE FOLLOWING

THE SYSTEM HAS BEEN FLUSHED IN ACCORDANCE WITH THE BOILER MANUFACTURER'S INSTRUCTIONS? ☐

THE SYSTEM CLEANER USED _____

THE INHIBITOR USED _____

FOR THE CENTRAL HEATING MODE, MEASURE & RECORD

GAS RATE _____ m³/hr _____ ft³/hr

BURNER OPERATING PRESSURE (IF APPLICABLE) ☐ N/A _____ mbar

CENTRAL HEATING FLOW TEMPERATURE _____ °C

CENTRAL HEATING RETURN TEMPERATURE _____ °C

FOR COMBINATION BOILERS ONLY

HAS A WATER SCALE REDUCER BEEN FITTED? YES ☐ NO ☐

WHAT TYPE OF SCALE REDUCER HAS BEEN FITTED? _____

FOR THE DOMESTIC HOT WATER MODE, MEASURE & RECORD

GAS RATE _____ m³/hr _____ ft³/hr

MAXIMUM BURNER OPERATING PRESSURE (IF APPLICABLE) ☐ N/A _____ mbar

COLD WATER INLET TEMPERATURE _____ °C

HOT WATER OUTLET TEMPERATURE _____ °C

WATER FLOW RATE _____ lts/min

FOR CONDENSING BOILERS ONLY CONFIRM THE FOLLOWING

THE CONDENSATE DRAIN HAS BEEN INSTALLED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS? YES ☐

FOR ALL INSTALLATIONS CONFIRM THE FOLLOWING

THE HEATING AND HOT WATER SYSTEM COMPLIES WITH CURRENT BUILDING REGULATIONS ☐

THE APPLIANCE AND ASSOCIATED EQUIPMENT HAS BEEN INSTALLED AND COMMISSIONED IN ACCORDANCE WITH THE MANUFACTURER'S INSTRUCTIONS ☐

IF REQUIRED BY THE MANUFACTURER, HAVE YOU RECORDED A CO/CO₂ RATIO READING? N/A ☐ YES ☐ CO/CO₂ RATIO _____

THE OPERATION OF THE APPLIANCE AND SYSTEM CONTROLS HAVE BEEN DEMONSTRATED TO THE CUSTOMER ☐

THE MANUFACTURER'S LITERATURE HAS BEEN LEFT WITH THE CUSTOMER ☐

COMMISSIONING ENG'S NAME PRINT _____ CORGI ID No. _____

SIGN _____ DATE _____

SERVICE INTERVAL RECORD

It is recommended that your heating system is serviced regularly
and that you complete the appropriate Service Interval Record Below.

Service Provider. Before completing the appropriate Service Interval Record below, please ensure you have carried out the service as described in the boiler manufacturer's instructions. Always use the manufacturer's specified spare part when replacing all controls

SERVICE 1 DATE

ENGINEER NAME

COMPANY NAME

TEL No.

CORGI ID CARD SERIAL No.

COMMENTS

SIGNATURE

SERVICE 2 DATE

ENGINEER NAME

COMPANY NAME

TEL No.

CORGI ID CARD SERIAL No.

COMMENTS

SIGNATURE

SERVICE 3 DATE

ENGINEER NAME

COMPANY NAME

TEL No.

CORGI ID CARD SERIAL No.

COMMENTS

SIGNATURE

SERVICE 4 DATE

ENGINEER NAME

COMPANY NAME

TEL No.

CORGI ID CARD SERIAL No.

COMMENTS

SIGNATURE

SERVICE 5 DATE

ENGINEER NAME

COMPANY NAME

TEL No.

CORGI ID CARD SERIAL No.

COMMENTS

SIGNATURE

SERVICE 6 DATE

ENGINEER NAME

COMPANY NAME

TEL No.

CORGI ID CARD SERIAL No.

COMMENTS

SIGNATURE

SERVICE 7 DATE

ENGINEER NAME

COMPANY NAME

TEL No.

CORGI ID CARD SERIAL No.

COMMENTS

SIGNATURE

SERVICE 8 DATE

ENGINEER NAME

COMPANY NAME

TEL No.

CORGI ID CARD SERIAL No.

COMMENTS

SIGNATURE

SERVICE 9 DATE

ENGINEER NAME

COMPANY NAME

TEL No.

CORGI ID CARD SERIAL No.

COMMENTS

SIGNATURE

SERVICE 10 DATE

ENGINEER NAME

COMPANY NAME

TEL No.

CORGI ID CARD SERIAL No.

COMMENTS

SIGNATURE

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